FARR CANADA

A Division Of McCoy Corporation

CM 14500 14-1/2"

TRAILER-MOUNTED BUCKING UNIT

Technical Manual

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While continually striving to maintain accuracy, Farr Canada hereby states that the information contained in this technical documentation is subject to change without notice. If you feel this document does not meet your needs, please contact our sales office for the most current available documentation for your product.

Summary Of Revisions			
Date	**Section**	**Page**	**Description Of Revision**
Dec 2005	N/A	N/A	Intial Release
May 2007	N/A	iii	Added Summary Of Revisions table
	1	1.4	Corrected lubricant specifications page
	3	3.6 - 3.10	Replaced hydraulic schematic, corrected hydraulic component identification information.
	3	3.12 - 3.13	Added jaw part numbers, updated replacement procedures.
	7	7.18 - 7.19	Corrected drawing and parts list for hydraulic shifter.

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IDENTIFICATION OF OF WARNINGS AND OTHER NOMENCLATURE OF IMPORTANCE USED IN THIS MANUAL

Farr Canada uses three subsets to describe items in three degrees of importance.

*The highest level of urgency is called a **CRITICAL WARNING**, and is identified with an exclamation point, has red text, and is surrounded by a double black box. A CRITICAL WARNING denotes an item of extreme importance, and failure to heed a warning may result in bodily injury, death, severe equipment damage, or any combination of these.*

*A **STANDARD WARNING** is identified with an asterisk, and contains information critical to the correct assembly or operation of the unit. A STANDARD WARNING may also serve to alert the user to a potential low-level injury hazard. A STANDARD WARNING is also surrounded by a double black box, but the text is amber in colour.*

*An **ALERT** is identified by black text within a double black box. An alert contains specific information of note that pertains to the correct assembly or operation of the unit.*

! This is how to identify a critical warning

* This is how to identify a standard warning

This is how to identify an alert

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Congratulations on the purchase of your new, customized, trailer-mounted FARR 14 1/2" Bucking Unit. Expect many years of outstanding performance and reliability. This manual will provide you with the information necessary to adequately care for your new equipment. Performing the simple maintenance procedures in this manual will extend its life and ensure continuing excellent performance and reliability.

Replacement parts are readily available from FARR Canada Ltd. in Edmonton Alberta. However, many of the consumable parts are common items, and are likely to be found in supply stores or parts depots. In addition, many parts are transferable between FARR tongs and backups.

Should you need replacement parts, or should you experience any difficulty not covered in this manual, please contact:

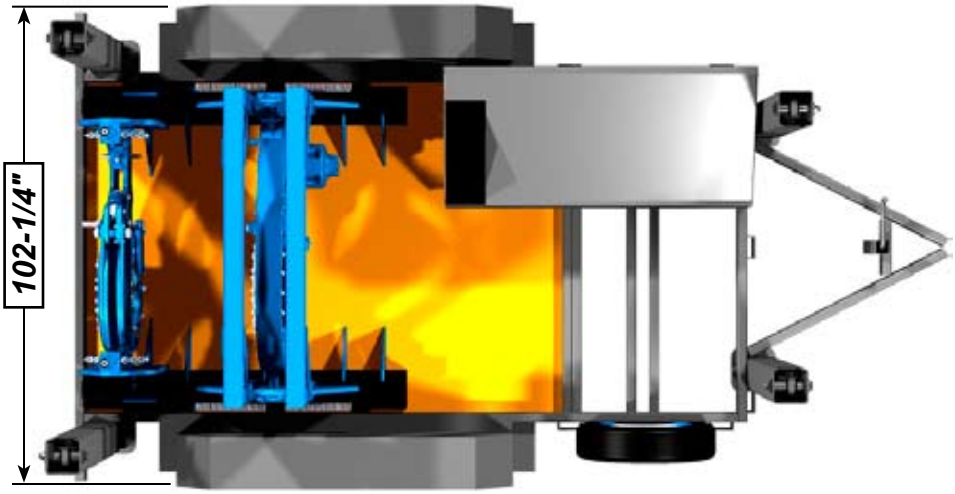
FARR CANADA (SALES)
11086 156 Street, Suite 216
Edmonton, Alberta
Canada T5P 4M8
Phone: 780.481.3174
Fax: 780.481.9246

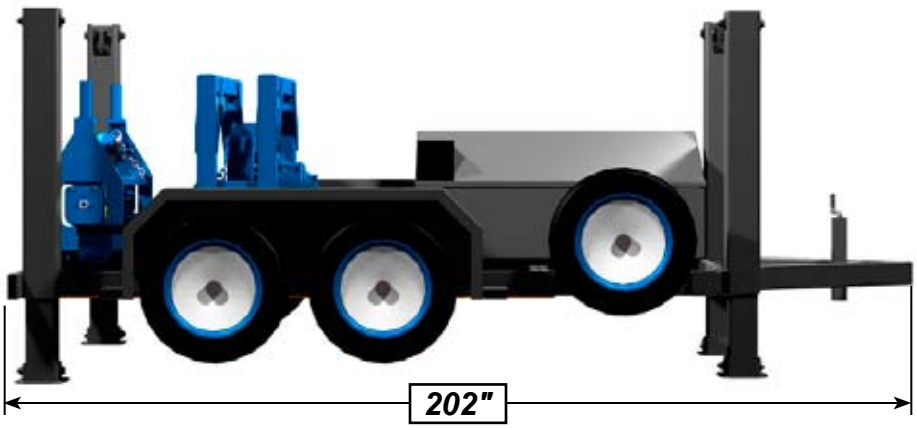
FARR CANADA (ENGINEERING)
14755 121A Avenue
Edmonton, Alberta
Canada T5L 2T2
Phone: 780.453.3277
Fax: 780.455.2432

Email Sales: info@farrcanada.com

Email Engineering: eng@farrcanada.com

Website: http://www.farrcanada.com





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Torque Range @ 2,500 PSI:	High Gear: 4677 ft.-lb. / 6343 Nm Low Gear: 35000 ft.-lb. / 47360 Nm
Maximum RPM at 50 GPM / 189 LPM	High: 40 RPM Low: 8 RPM
Hydraulic Requirements:	50 GPM @ 1000 psi / 189 LPM @ 6.9 MPa 10 GPM @ 2000 psi / 37.8 LPM @ 13.8 MPa
Overall Length:	202 inches / 5.13 meters
Overall Width:	102 inches / 260 cm
Overall Height:	74 inches / 188 cm
Space Required On Pipe:	8 inches / 20.3 cm
Maximum Elevator Diameter:	Unlimited (tong comes off pipe)
Torque arm length:	36 inches / 91.44 cm Center Line of Pipe - Center Line of Anchor Handle
Weight (Approximate):	4500 lb. / 2043 kg.
Casing Jaws Available (inches):	4-1/2, 5, 5-1/2, 6-5/8, 7, 7-5/8, 8-5/8, 9-5/8,10-3/4, 11-3/4, 13-3/8, & 14-1/2.

Patented & Patents Pending

Use an EP synthetic grease that meets or exceeds the following specifications:

Thickener	*Lithium Complex*
NLGI consistency grade	*2*
NLGI performance grade	*GC-LB*
Penetration - ASTM D 217 (25°C [77°F] 0.1 mm) worked 60 strokes	*265-295 minimum*
Dropping point, °F[°C] - ASTM D2265	*550 [288] minimum*
High temperature life, hours - ASTM D 3527	*160 minimum*
Oxidation stability, psi - ASTM D 942	*(100 hr/300 hr) 0/3*
Water washout, percent - ASTM D 1264	*1.8 max*
Rust and corrosion - ASTM D 1743	*pass*
Oil separation, percent loss - ASTM D 1742 (24 hours, 25°C [77°F]	*1.1 max*
Leakage, g lost - ASTM D 4290	*1.0 max*
Four ball wear test, mm scar - ASTM D 2266	*0.40 max*
Fretting wear, mg - ASTM D 4170	*3.4 max*
Four ball EP, kgf - ASTM D 2596	
Weld point	*400 minimum*
Load wear index	*50 minimum*
Timken OK load test, lbs - ASTM D 2509	*50*
*Low temperature torque, N*m - ASTM D 4693 (-40°C [-40°F])*	*1.3 max*
LT-37 pumpability, g/min (60°F/0°F [16°C/-18°C])	*360/7*
Copper corrosion - ASTM D 4048	*1B*
Disc brake wheel bearing specifications	
Ford ESA-M1C 198A	*Yes*
Chrysler MS-3701	*Yes*
Oil viscosity: 40°C [104°F], cSt	*151*
100°C [212°F], cSt	*19.2*
Flash point, °F[°C] - ASTM 92	*450[232]*

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Use a premium quality hydraulic fluid that meets or exceeds the following specifications:

Typical Density (kg/m^3)	*878*
Viscosity - cSt @ 40 °C	*68.8*
- cSt @ 100 °C	*8.7*
Viscosity Index	*97*
Pour Point °F [°C]	*-22 [-30]*
Flash Point °F [°C]	*432 [222]*
Colour, ASTM	*1.5*
Neutralization Number	*0.40*
Rust Protection - Distilled Water	*No Rust*
- Sea Water	*No Rust*
Hydrolytic Stability - Cu Mass Loss, mg/cm^2	*0.04*
Copper Corrosion Test	*1A*
Filterability: Denison - Wet & Dry	*Pass*
Afnor - Wet & Dry	*Pass*
Cincinatti Milacron Spec Approved	*P69*
Denison HF-0:	*Approved*
Denison P-46 Piston Pump:	*Pass*
Denison T6C Vane Pump:	*Pass*
Vickers 35VQ25 Vane Pump Test:	*Pass*
104/105C Vane Pump Test:	*No Data Available*
Vane pump test total ring and vane wear, mg.	*<10*
Oxidation Stability	
Turbine Oil Stability Test Life, hours	*2500+*
Rotary Bomb Oxidation Test, minutes	*325*
FZG Spur Gear Test, Failure Load Stage (FLS)	*12*

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The Farr Hydraulic Power Tong has been designed such that assembly is simple and can be accomplished without the use of special tools. The following sequence is presented as a guide only for the technician performing assembly as it would take place in our plant. Much emphasis has been placed on disassembly and reassembly in the maintenance and overhaul section of this manual. Therefore, use this assembly section only to aid in familiarization of parts and their locations, and use the overhaul and maintenance section as a specific guide to assembly.

ASSEMBLY SEQUENCE

1. *Position the tong body gear case on a suitable stationary support such that the bottom body plate is accessible.*
2. *Install bottom pinion bearing and bearing cap.*
3. *Install bottom clutch bearing and bearing cap.*
4. *Install rotary roller shafts, rollers, bearings and spacers.*
5. *Install rotary drive gear. (Limit grooves should be face side up).*
6. *Install rotary idler gears, bearings, shafts and spacers, making sure microgrooves in gear are in upright and proper position. (Micro-groove gear should be located on the gear shift lever side of tong).*
7. *Install bottom pinion gear (shoulder side down).*
8. *Install pinion gear shaft into the spline of the bottom pinion gear.*
9. *Install clutch shaft, needle bearings, bottom clutch gear.*
10. *Install pinion idler gears, bearings and half shafts.*
11. *Install shifting collar which will slip over clutch shaft and mesh with low or high clutch gear.*
12. *Position the shifting shaft (with shifting yoke attached) on the shifting collar.*
13. *Install top pinion gear (shoulder side up).*
14. *Install top clutch gear.*
15. *Position the top plate in its proper location and insert dowel pins.*
16. *Align mounting holes of pinion idler half shafts with top plate, and install (half moon) pads and bolts.*
17. *Install top clutch bearing, retainer and bushing.*
18. *Install clutch drive gear and retainer.*
19. *Install motor mount.*
20. *Install shifting cylinder.*
21. *Install rotary idler pads and nuts, pinion idler shaft nuts, roller shaft nuts, and then secure the top plate in place with bolts around perimeter of tong.*
22. *Install top pinion bearing and bearing cap.*
23. *Install motor and valve assembly.*

ASSEMBLY SEQUENCE (continued...):

24. *Install brass ring.*
25. *Install top cage plate.*
26. *Install bottom cage plate.*
27. *Install brake.*

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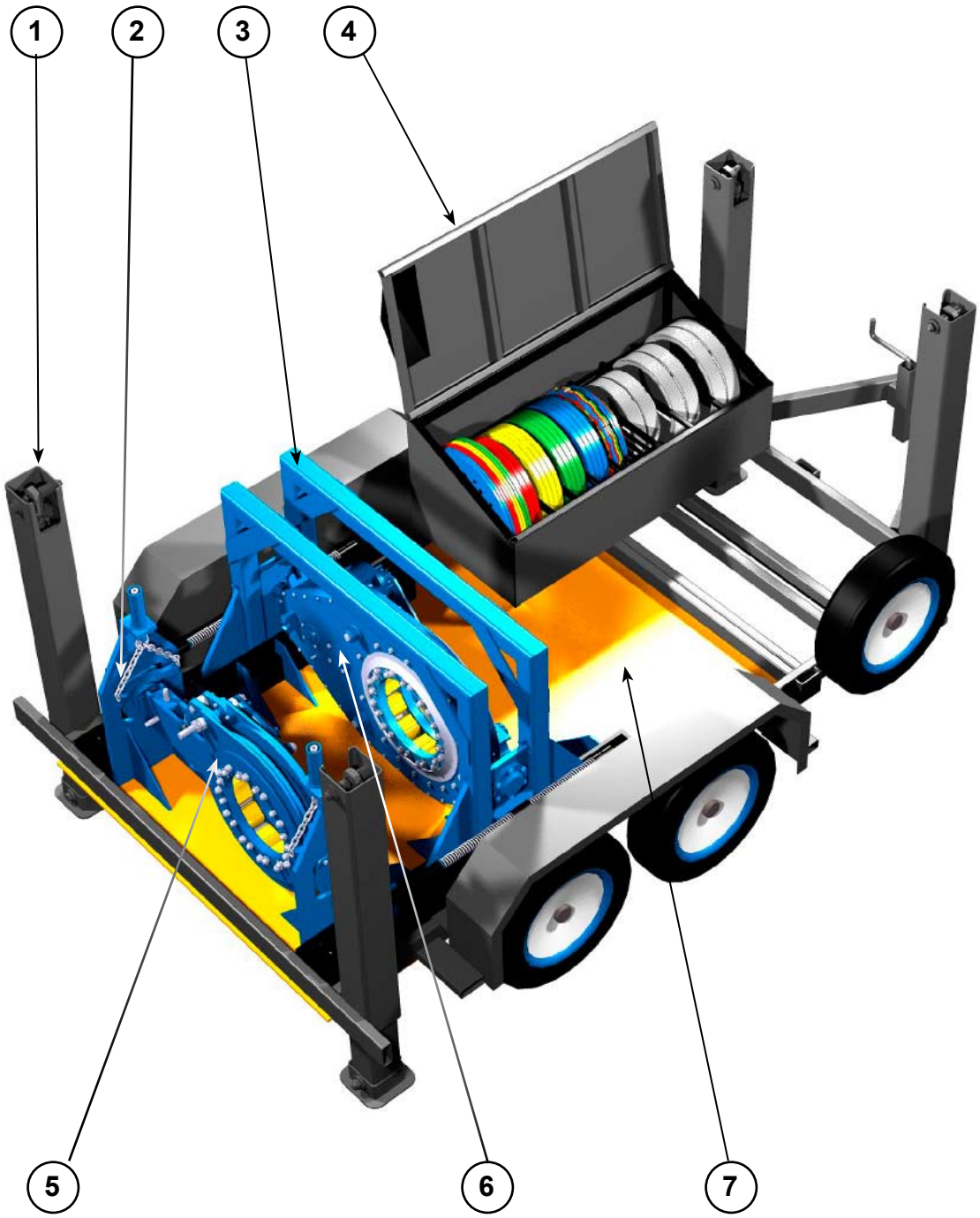
Adequate setup and proper hydraulic connections are essential in ensuring reliable operation of your tong. For best results and long term reliability, read and obey the start-up instructions in this section.

A. MAJOR COMPONENT IDENTIFICATION



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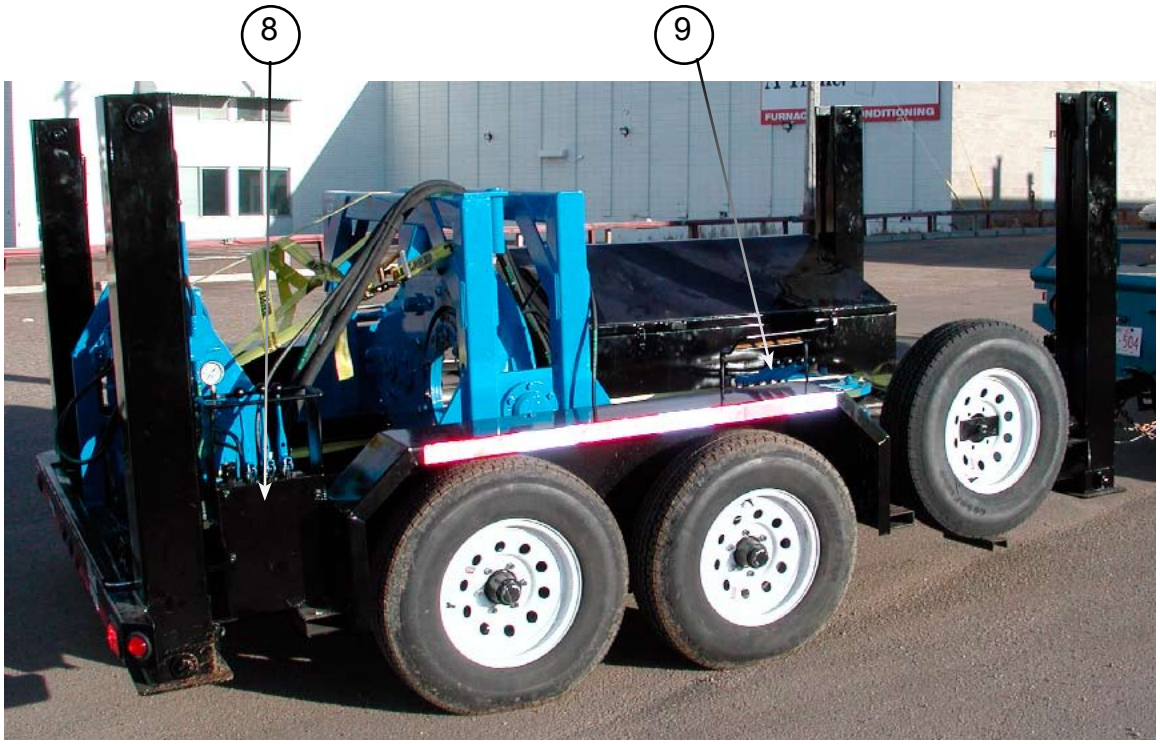

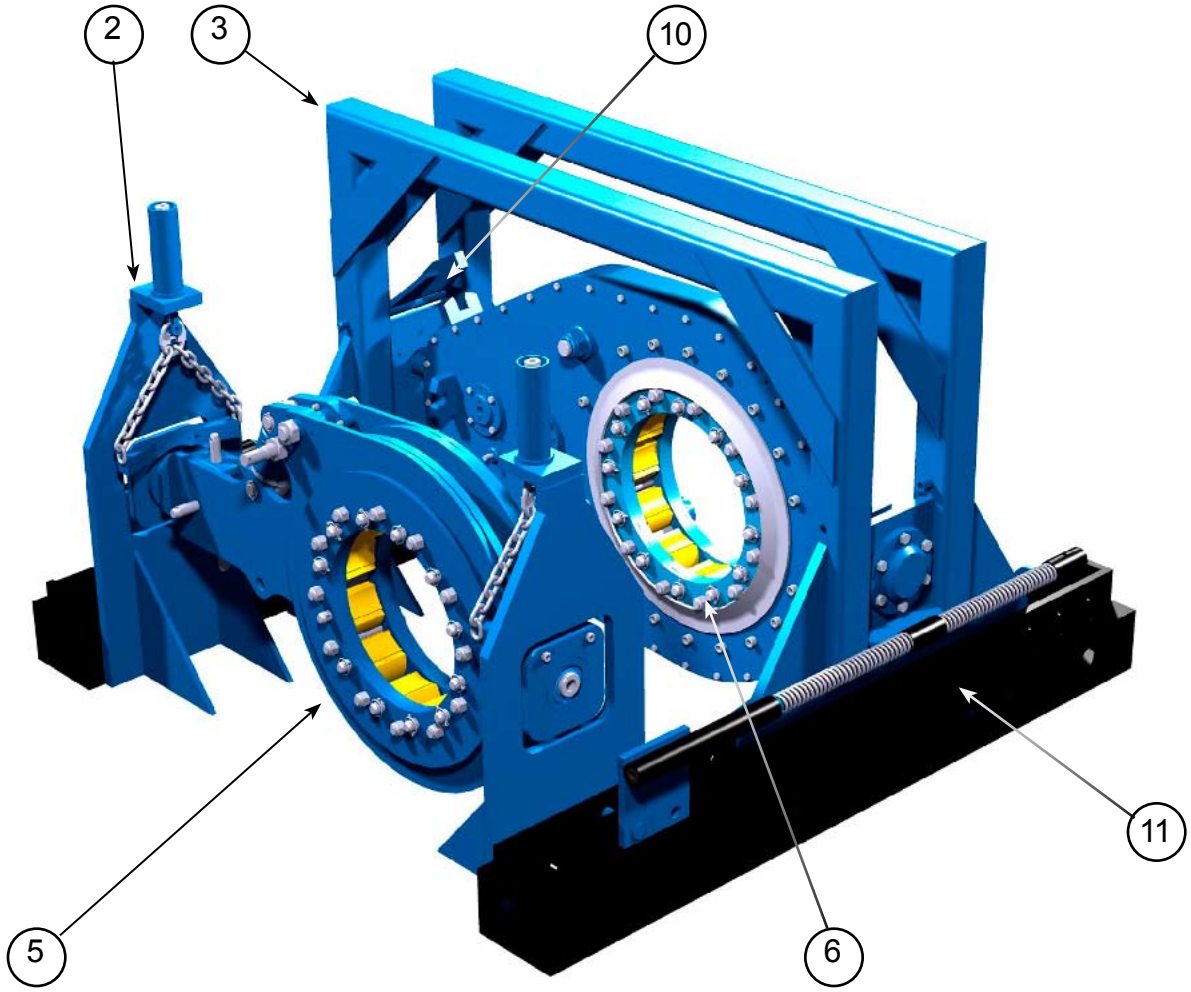

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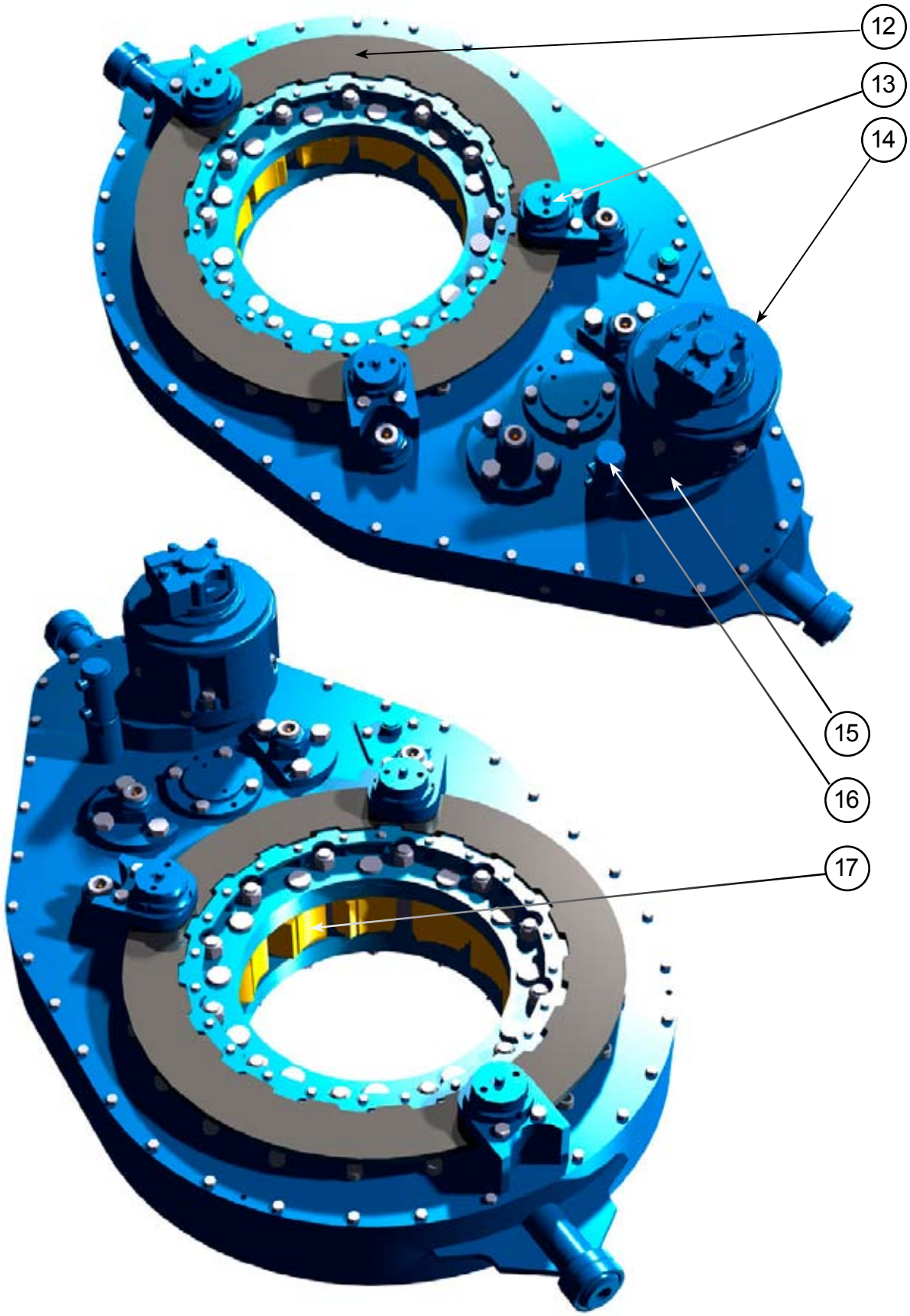

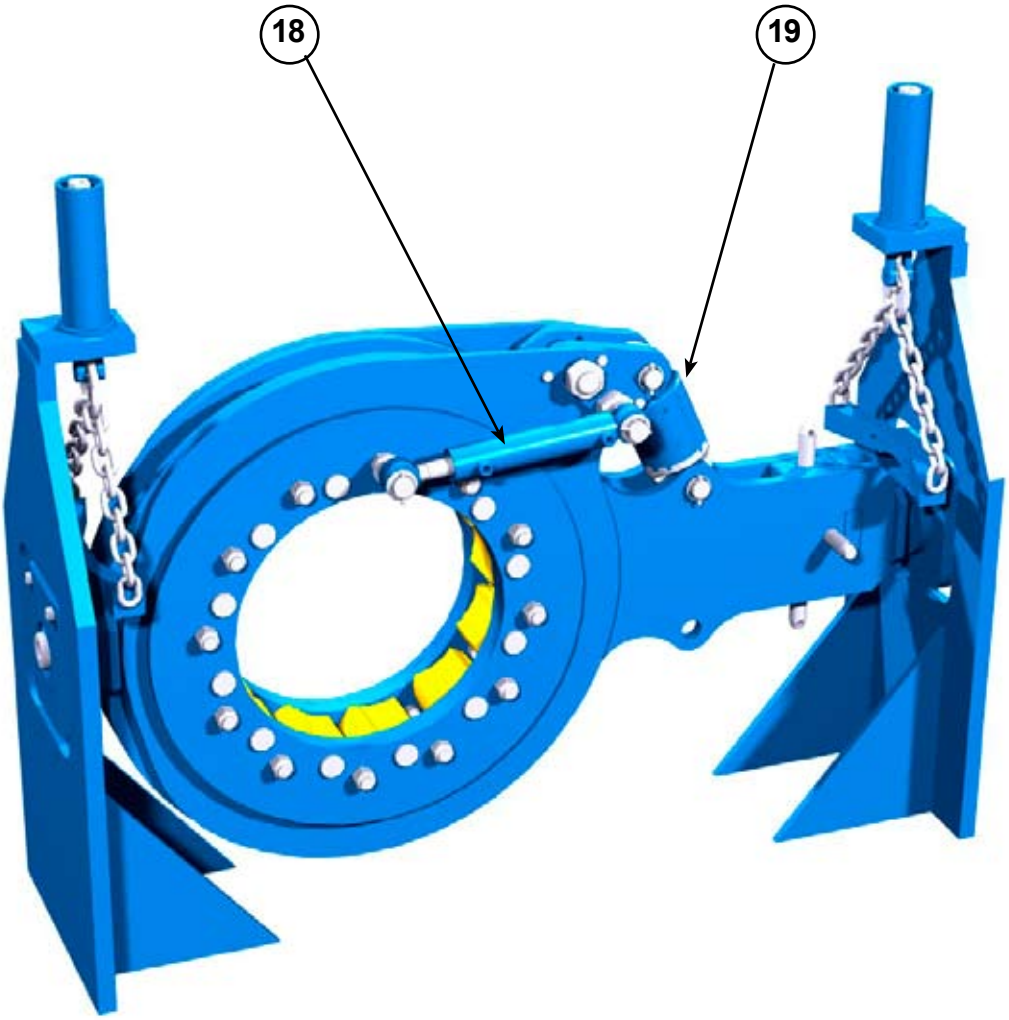

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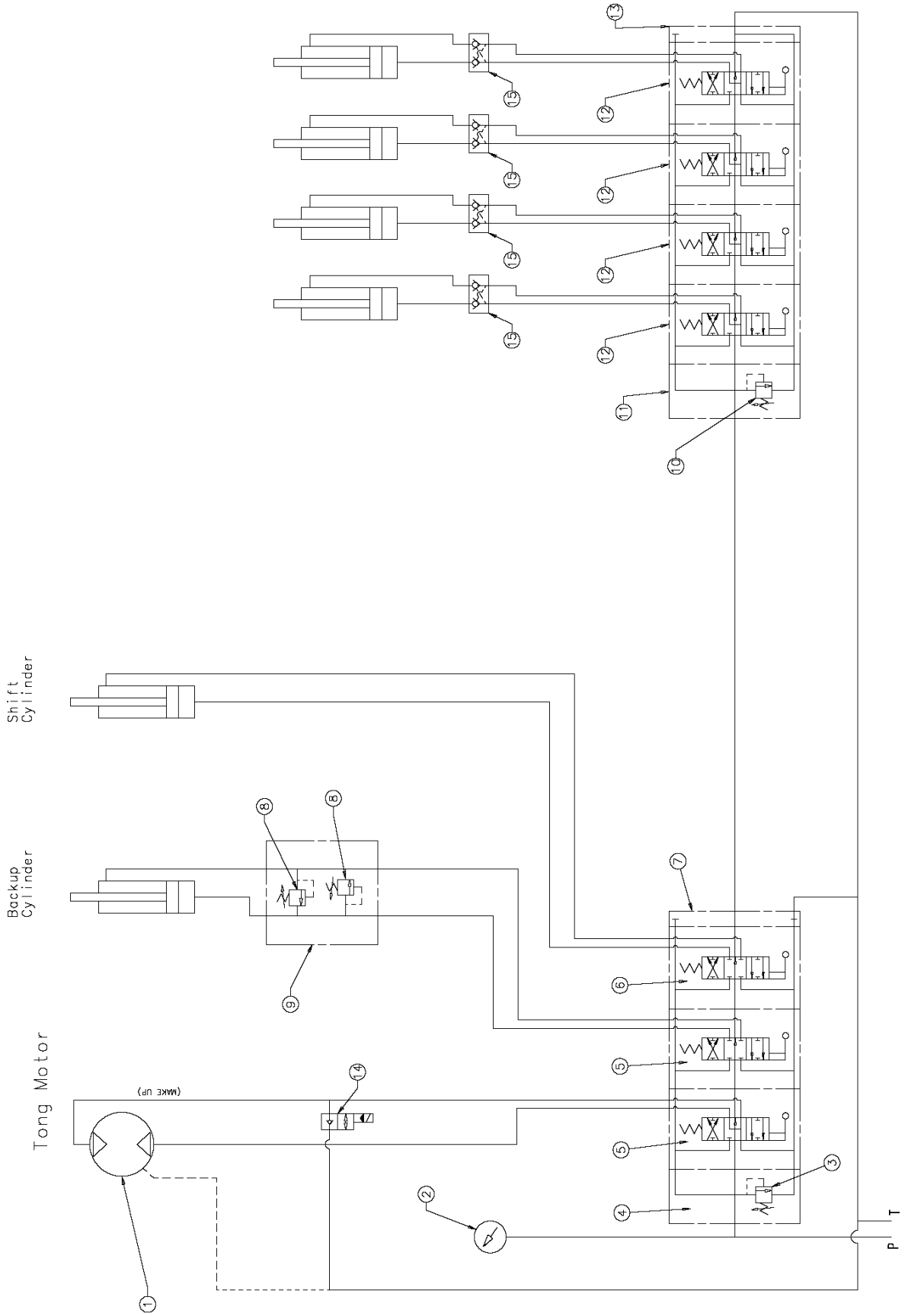
Item	Description	Page
1	Tong	3.1
2	Tong Carriage	3.1
3	Frame Weldment	3.1
4	Backup	3.1
5	Backup Spring Return Carriage	3.1
6	Fixed Pipe Roller Stand	3.1, 3.6
7	Tong Door	3.2
8	Rotary Gear Assembly	3.2
9	Tong Door Cylinder	3.2
10	Tong Jaw c/w Dies	3.2
11	Cage Plate Assembly	3.3
12	Brake Band Assembly	3.3
13	Backing Pin Assembly	3.3
14	Motor Mount	3.3
15	Hydraulic Motor	3.3
16	Shift Cylinder Assembly	3.4
17	Control Valve Bank	3.4
18	Backup Door Cylinder	3.5
19	Backup Door	3.5
20	Backup Door Latch Cylinder	3.5
21	Backup Door Latch	3.5
22	Backup Die Holder	3.5
23	Load Cell	3.6
24	Fixed Pipe Roller Gate	3.6
25	Remote Pipe Roller Stand	3.7
26	Pipe Roller Stand Lift Cylinder	3.7

B. HYDRAULIC COMPONENT IDENTIFICATION



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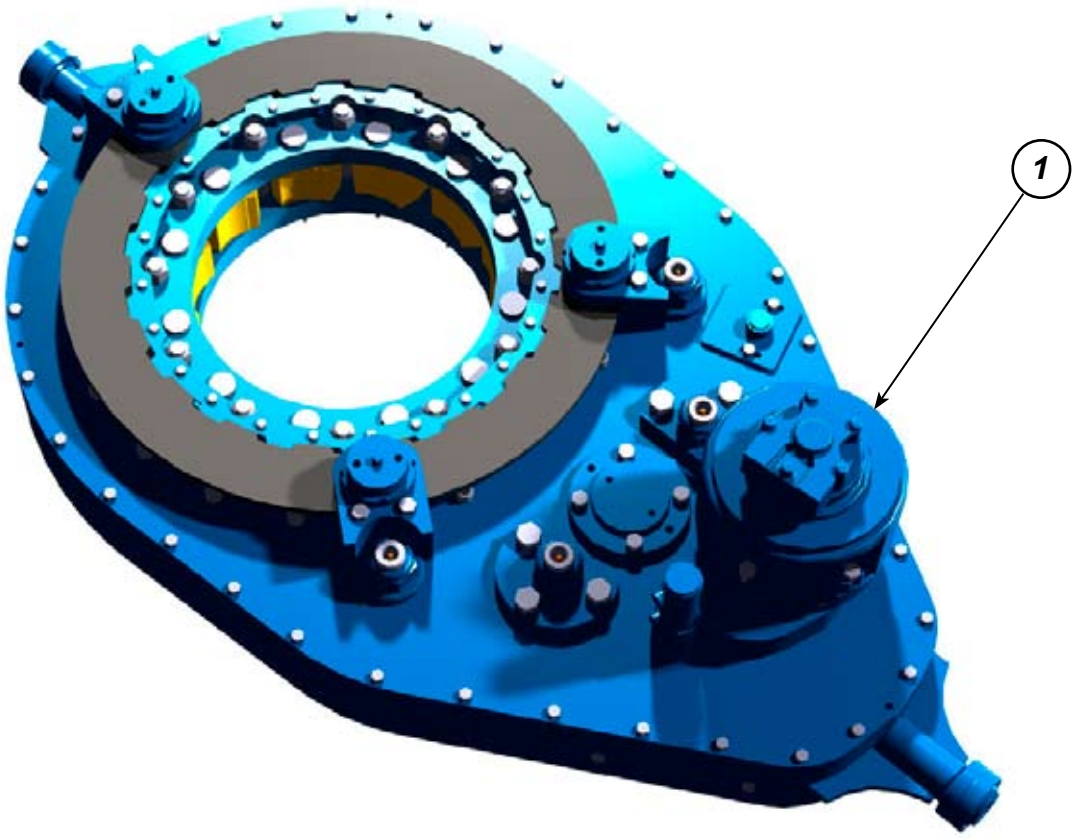

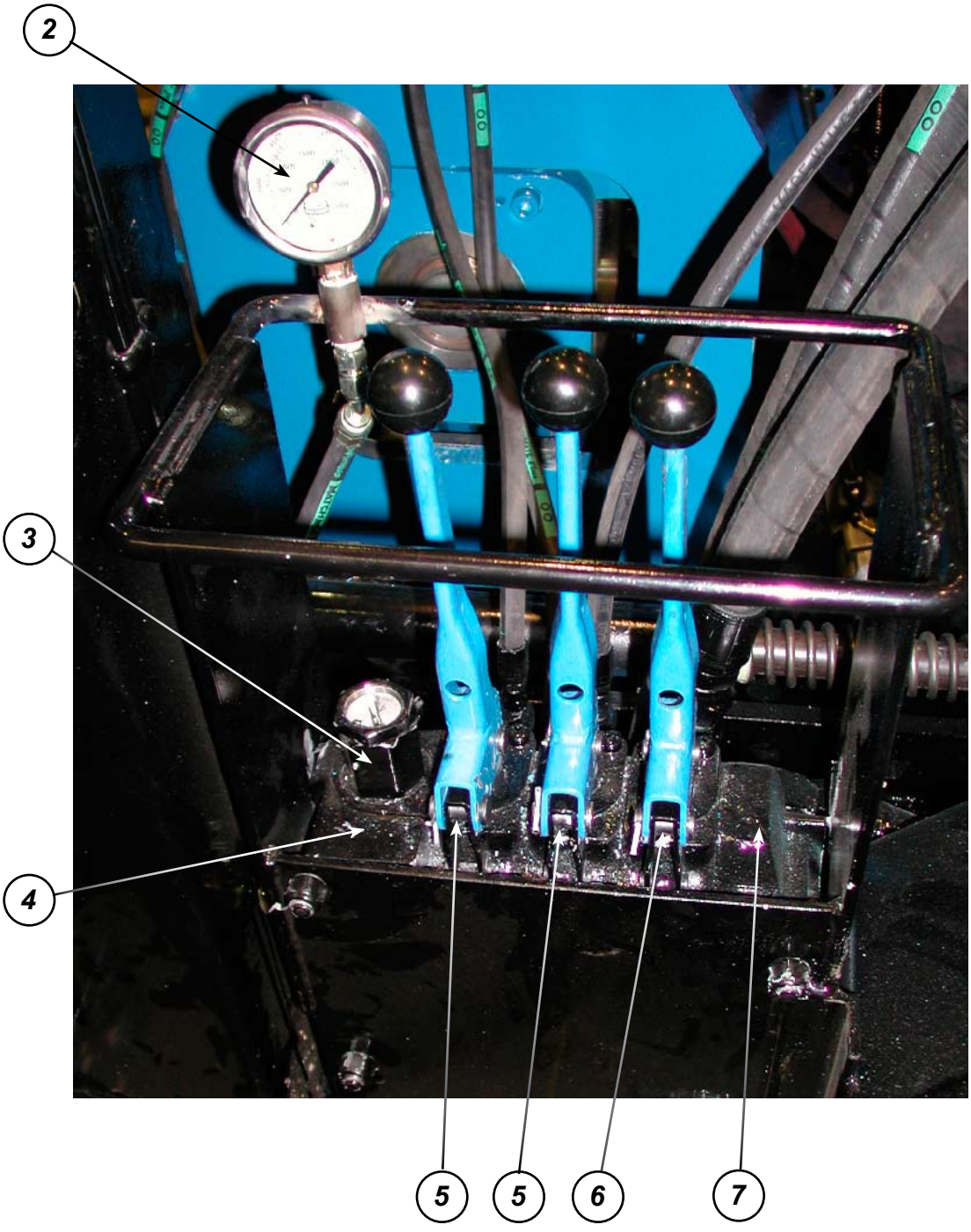

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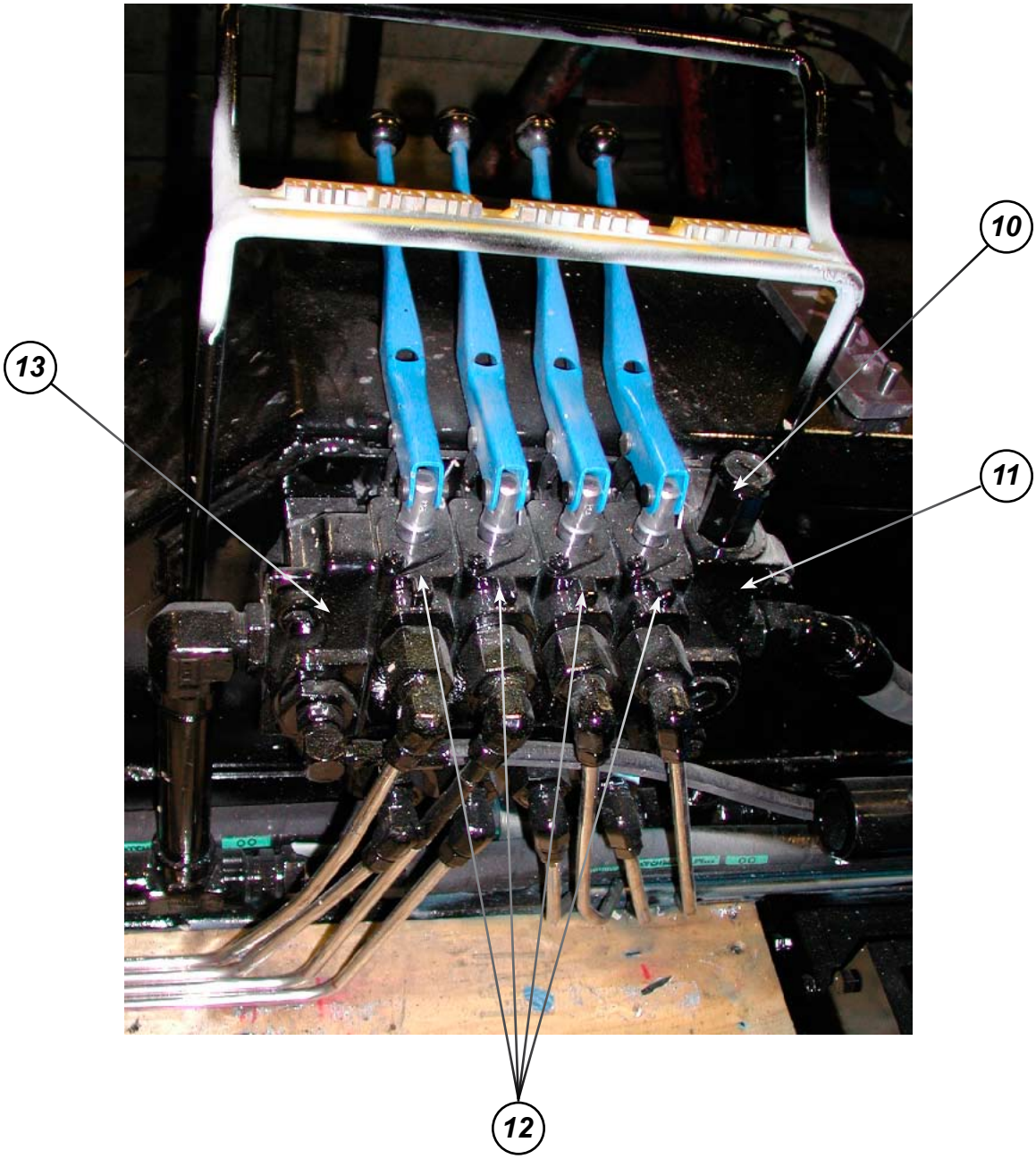

Item	Description	Part Number	Page
1	Hydraulic Motor, SAI GM1-250	87-0148	3.7
2	Pressure Gauge 0 - 3000 psig	02-0245	3.8
3	Relief Valve Cartridge, DVA35-MRV-2	10-0062	3.8
4	Inlet Section, DVA35-A880	10-9016	3.8
5	Motor Valve Section, DVA35-MA8	10-9014	3.8
6	Backup Valve Section, DVA35-DA8	10-9019	3.8
7	Outlet Section, DVA35-PB09	08-1825	3.8
8	Relief Valve Cartridge, RPEC-LAN	08-0095	3.9
9	Cross Port Relief Valve Block, Sun YFI	08-1801	3.9
10	Relief Valve Cartridge, DVA20-MRV	10-0025R	3.9
11	Inlet Section, DVA20-A880	10-0025	3.9
12	Double-Action Valve Section, DVA20-DA7	10-0072	3.9
13	Outlet Section, DVA20-TR88	10-0027	3.9
14	Dump Valve, Vickers SV1-16	60-0322	
15	Cross-Port Check Valve, CKEB-XCN, c/w body, Sun YEI	08-0481 / 08-1898	

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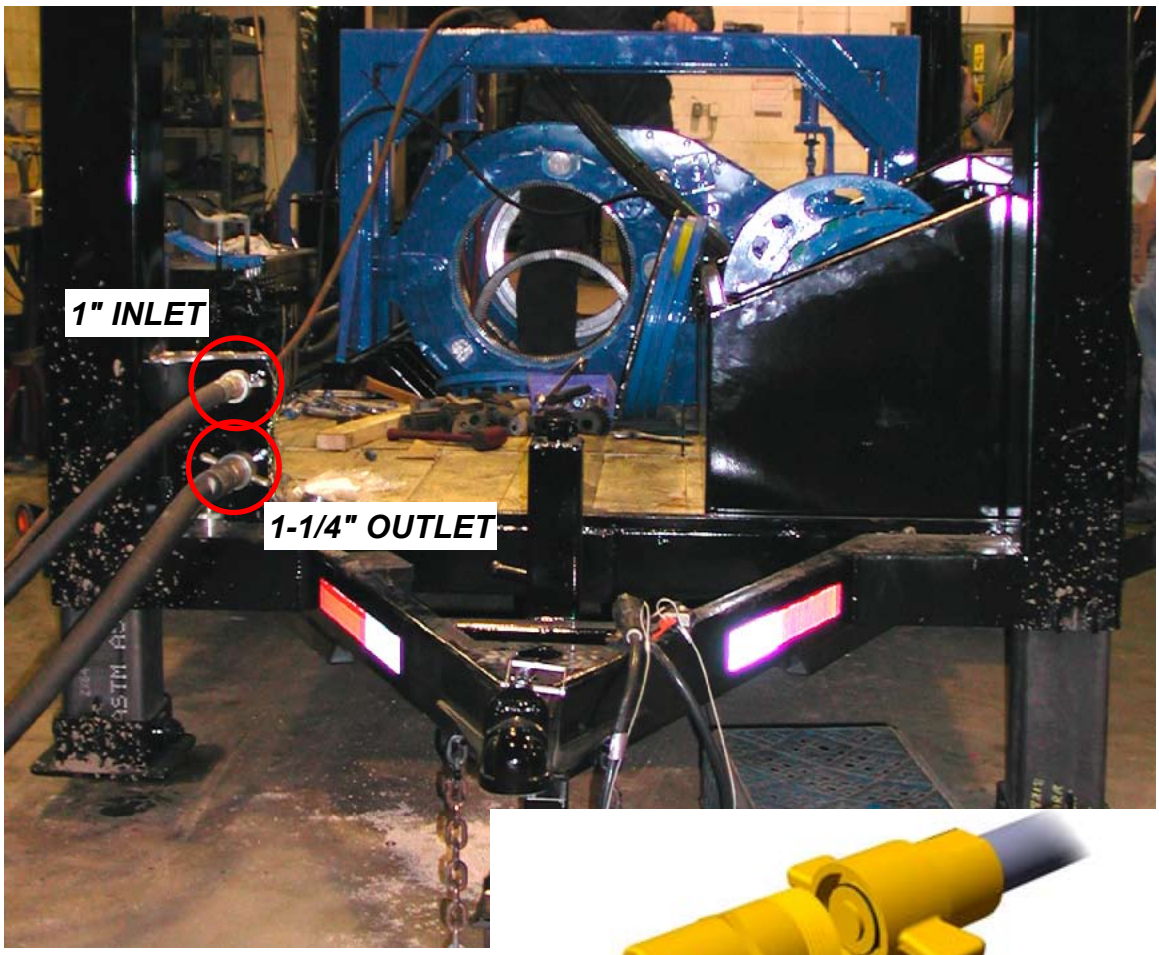
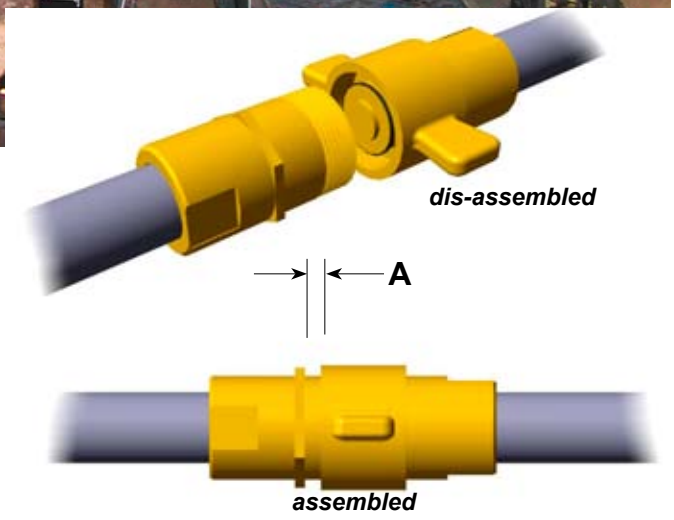
C. HYDRAULIC CONNECTIONS

A pair of hydraulic lines - a 1-1/4" supply line and a 1" return line - connect the bucking unit to the power unit (see illustration below). Ancillary devices (hydraulic motors, lift cylinders, etc.) are connected through the valve block illustrated below.

Perform any hydraulic connection when the power unit is not running, or when the hydraulic pump is disengaged. The possibility of error in inter-changing the high pressure supply hose and the low pressure return hose has been eliminated, because the supply side coupling is smaller than the return side. These hose couplings are self-sealing, and care should be taken to ensure complete engagement to prevent partial closure of the check valve in the coupling. Ensure that the nut (female) side is completely made up onto the male connector - there is a line on the male fitting that indicates complete make-up. Snug the female fitting right up to the line.





D. TONG JAW AVAILABILITY & INSTALLATION

1. AVAILABLE JAWS

The following table lists all jaw die kits that are available as standard sizes for this model of tong. If your desired size is not listed, Farr can engineer custom jaw sizes - contact the sales department for further information.

Referring to the following table when choosing the required jaw for your application:

		PIPE RANGE	PIPE RANGE	PIPE RANGE
RINGS REQUIRED	NUMBER OF JAWS	USE DIE SIZE 5 TO 4	USE DIE SIZE 4-1/2 TO 3-1/2	USE DIE SIZE 3-1/2 TO 2-7/8
MASTER RING BLUE PLATES	**Standard Jaw 12**	**OD 13-5/8 to 14-5/8**	**OD 13-1/8 to 14-1/8**	**OD 12-1/2 to 13-1/8**
	Long Jaw 6	**OD 12 to 12-1/2**	**OD 11-5/8 to 12-1/8**	**OD 11 to 11-1/2**
RING A RED PLATES	**Standard Jaw 10**	**OD 11-1/2 to 12-1/2**	**OD 11 to 12**	**OD 10-3/8 to 11**
	Long Jaw 5	**OD 10-1/4 to 11-1/2**	**OD 9-3/8 to 10**	**OD 8-7/8 to 9-1/2**
RING B YELLOW PLATES	**Standard Jaw 8**	**OD 9-3/8 to 10-3/8**	**OD 8-7/8 to 9-7/8**	**OD 8-1/4 to 8-7/8**
	Long Jaw 4	**OD 7-3/8 to 8-1/8**	**OD 7-1/8 to 8**	**OD 6-1/2 to 7-3/8**
RING C GREEN PLATES	**Standard Jaw 7**	**OD 7-3/8 to 8-3/8**	**OD 6-7/8 to 7-7/8**	**OD 6-1/4 to 6-7/8**
	Long Jaw 7	**OD 5-3/8 to 6-1/4**	**OD 5 to 5-7/8**	**OD 5-3/8 to 4-5/8**
EACH PIPE SIZE REQUIRES A RING AND 5 PLATES FOR THE TONG AND 4 PLATES FOR THE BACKUP, EXCEPT FOR THE 13-5/8 AND ABOVE, WHICH USES THE MASTER RING IN THE TONG AND BACKUP WITH APPLICABLE DIES				

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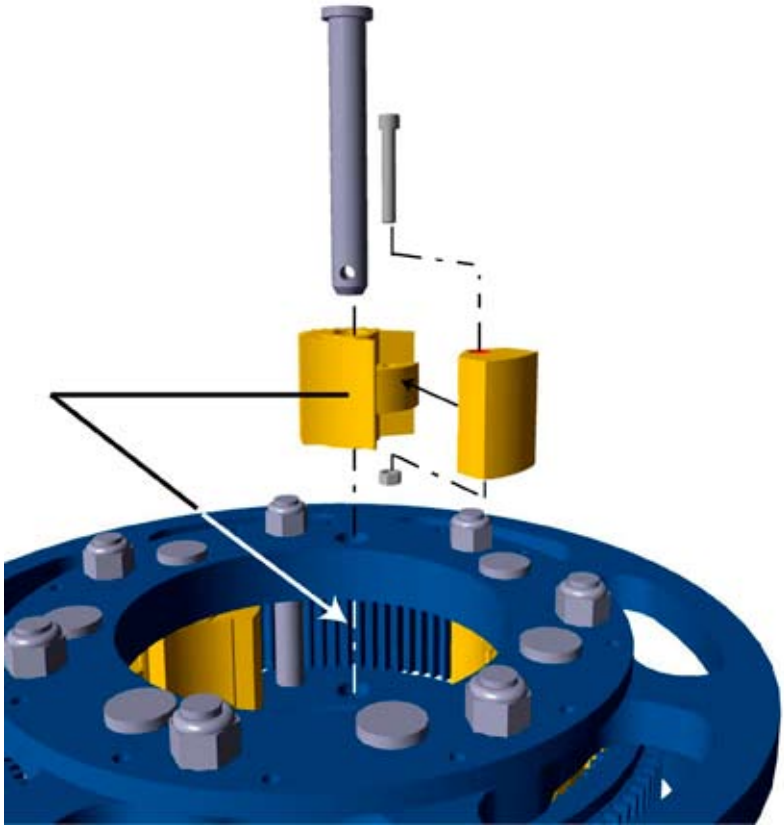
STANDARD JAWS	
Description	**Part Number**
2-7/8" - 3-1/2" Jaw Die Kit	01-JDK-620
3-1/2" - 4-1/2" Jaw Die Kit	01-JDK-625
4" - 5" Jaw Die Kit	01-JDK-630
Jaw Die Kits contain 5 EACH of the following: 01-J-04128 Jaw Jaw Insert in the specified size 1" Jaw Pin Insert Screw and matching lock nut	
LONG JAWS	
Note that there are no Jaw Die Kits Avalailable for the long jaws. Each "long jaw" accepts one of three different sizes of inserts, which then defines the pipe size application.	
Description	**Part Number**
Long Jaw	1234-J-1
2-7/8" - 3-1/2" Jaw Insert	12-1009
3-1/2" - 4-1/2" Jaw Insert	12-1010
4" - 5" Jaw Insert	12-1011

2. *JAW INSTALLATION*
Remove ringed linchpin, and slide die pin straight up out of the cageplate assembly. Slide out the die assembly, and disassemble by using an allan wrench to remove the 3/8" cap screw. Use caution not to lose the nut when removing the capscrew. This procedure is identical for the backup jaws. (see illustration below).



E. TONG OPERATION

1. INITIAL START UP & BREAK-IN PROCEDURE

ALTHOUGH YOUR NEW EQUIPMENT HAS BEEN TESTED AND INSPECTED AT THE FARR FACTORY PRIOR TO SHIPPING, WE ADVISE THOROUGH TESTING OF YOUR NEW TONG AFTER YOU TAKEN POSESSION IN ORDER TO ELIMINATE THE POSSIBILITY OF SHIPPING DAMAGE.

Farr recommends that the following pre-operating tests be performed prior to releasing the tong assemly to a operational environment:

- *Operate the tong at full speed and in high gear for a duration of one-half hour.*
- *Switch to low gear and operate for an additional one-half hour at full speed.*
- *Inspect all components and hydraulic fittings for possible defects following completion of the tests. All FARR Tongs have been throughly tested at the factory prior to shipping and any defects may be the result of shipping damage.*

Ensure adequate lube oil and hydraulic oil levels before starting engine. Use start up procedures as recommended by the power unit engine operator's manual. Open the Bypass Valve on the hydraulic system, and inspect all pressure and return line hose connections to ensure correct and secure installation.

IMPROPERLY SECURED HYDRAULIC CONNECTIONS WILL INTERRUPT HYDRAULIC FLUID FLOW, AND COULD RESULT IN THE FOLLOWING FAILURES:

- A restriction in the pressure supply hose will result in high pressure within the power unit hydraulic system, which will activate the hydraulic governor and increase the engine speed to as high as maximum RPM.
- A restriction in the return line will result in high pressure within the power unit and the tong hydraulic system, causing engine speeds as high as maximum RPM, and possible failure of the motor seal.

Following inspection of the hoses, start the engine and allow it to idle until warm. Allow hydraulic fluid to circulate for approximately 10 minutes, then slowly close the Bypass Valve to allow hydraulic fluid to circulate through the hoses and to the tong (circulating pressure should not exceed 200 psi). Place the tong gear shifter in low gear and rotate the tong slowly forward and then reverse with the throttle valve control lever. Once this has been done and the proper size jaws have been installed, the tong is then ready to run pipe.

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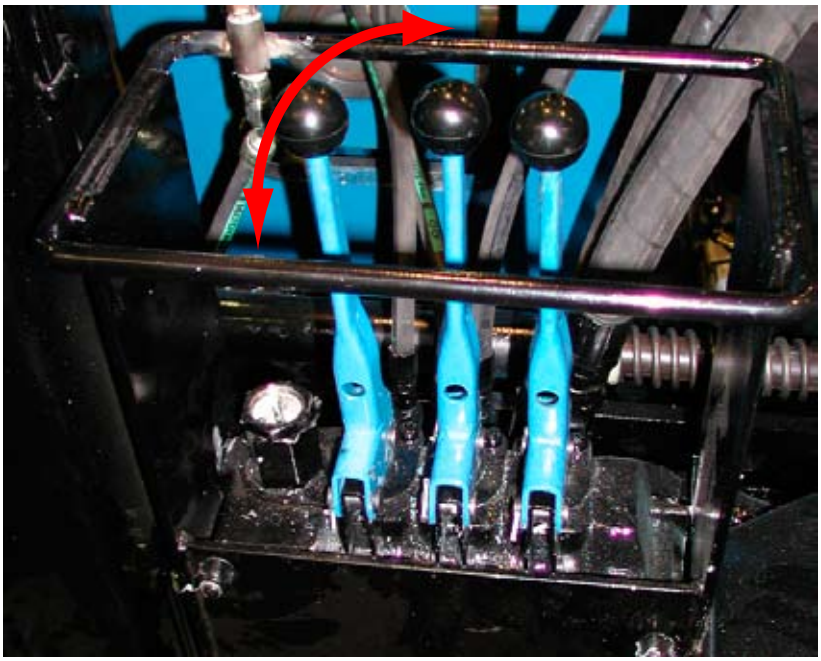
2. VALVE OPERATION

4-way proportional valves control operation of hydraulic devices on the bucking unit such as hydraulic motors and lift cylinders. When any one valve is "centered" or in the detent position, there is no hydraulic output from the valve. When the valve is pushed forward there is an effect, and when the valve is pulled back, there is an opposite effect. Several of the valves feature proportional control, which means that further extension of the valve handle (thereby further opening the valve orifice) results in proportionally higher hydraulic output to the controlled device. In the case of a tong motor the speed of the motor can be controlled by the position of the valve handle, in the case of a lift cylinder the rate of extension can be controlled, etc. Some valves are sequenced valves, meaning that actuating a single valve will control two hydraulic devices in sequence.

The following illustrations demonstrate the type and effect of the three valves on the valve bank.

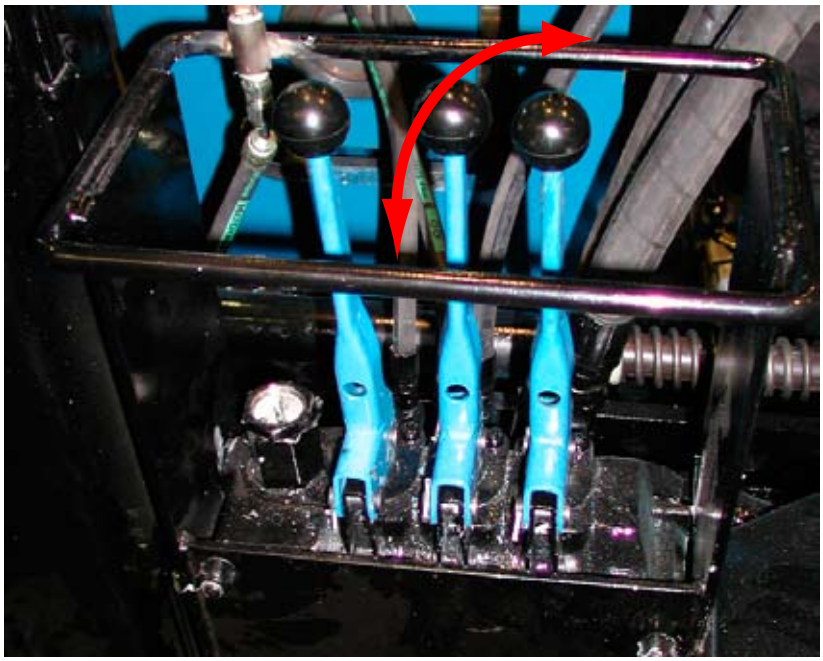
TONG MOTOR

This is a proportional valve. Pushing the valve handle forward will cause the tong motor to rotate in a clockwise direction (as seen from the motor side of the tong). This is the desired direction of rotation for making up a joint. Pulling the valve handle in the opposite direction results in counter--clockwise rotation, which is the desired direction of rotation for breaking out a joint.



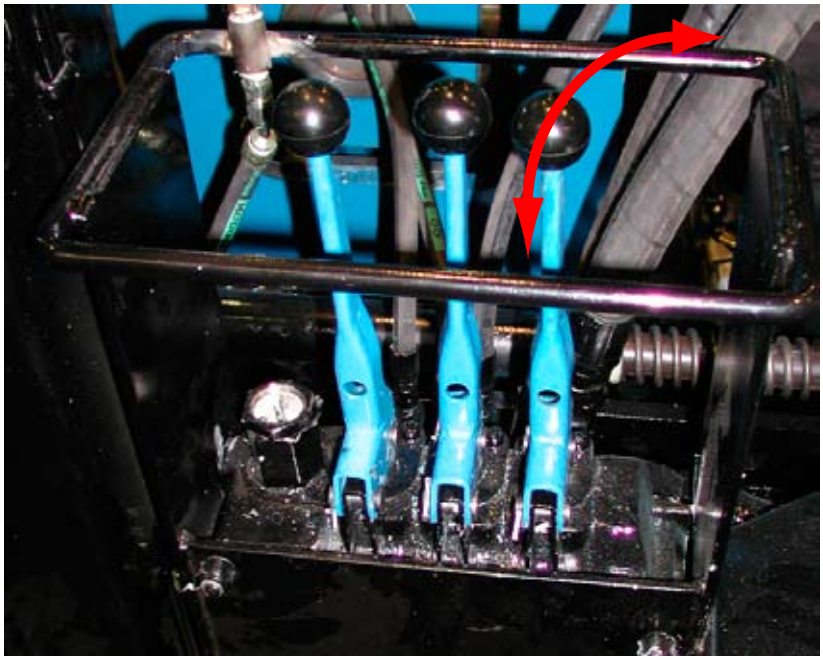
TONG SHIFT

This is a two-way direct acting valve, without proportional control. When the valve is in the middle (detent) position, the tong is in "neutral", or not rotating. Pulling the valve handle backward, or toward the operator, will cause the tong to begin rotating in low gear. Pushing the valve handle forward through the neutral position will cause the tong to shift to a higher gear, and increase the rotational speed. Note that maximum torque can only be applied with the tong in the low gear.



BACKUP

This is a two-way direct acting valve, without proportional control. Pushing the valve handle forward will cause the backup to engage. Pulling backward, towards the operator, reverses the operation.



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3. GENERAL COMMENTS

a) *Position rotary gear in contact with idler gears prior to breaking out joints or collars where high torques are required.*

b) *When making-up integral (shouldered) joints, it is essential to make up the last turn of the threads in low gear. This reduces the tendency of an instant stop or a sudden increase in torque, which induces extremely high stresses on the gear train.*

c) *DO NOT employ the "snap break" method of breaking-out joints. By definition, the "snap break" method is a procedure used by some operators to break-out connections, accomplished by leaving slack in the "jaw-pipe" engagement, and then quickly pulling the throttle valve control lever allowing the tong to snap into its loaded or high torque condition. Although this method is very effective in breaking out joints, the extremely high stress placed on the gear train frequently causes gear breakage.*

! **THE "SNAP-BREAK" METHOD IS HAZARDOUS TO OPERATING PERSONNEL**

F. EXTREME COLD WEATHER OPERATION PROCEDURES

1) *Consult the power unit engine operator's manual for all cold weather operating procedures and precautions.*

2) *Select gear and bearing lubricants that are compatible with expected climatic conditions.*

3) *Select hydraulic fluid that is compatible with expected climatic conditions.*

4) *Allow hydraulic fluid to circulate for approximately 20 minutes after starting the power unit, prior to activating the bypass valve to allow fluid to circulate to tong. If the power unit is equipped with an oil temperature gauge, ensure that the fluid has reached operating temperature as specified by hydraulic fluid data sheet.*

5) *Allow for adequate drying of moisture (prior to lubricating) when cleaning tong parts in cold weather.*

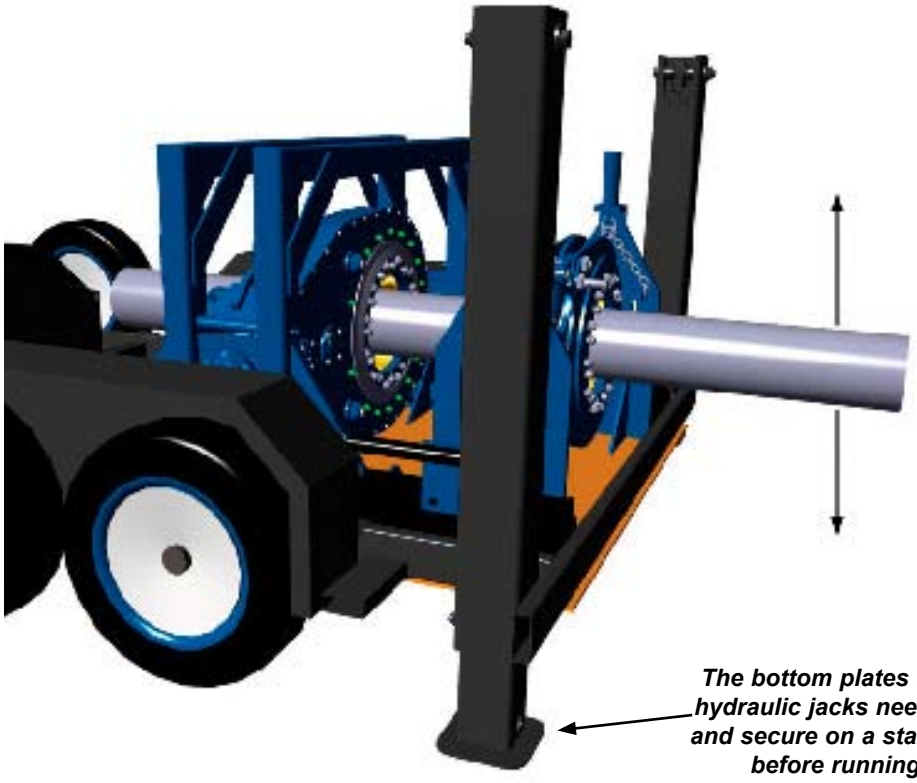
G. RUNNING PIPE

Stabilize and level the bucking unit on a secure surface using the four hydraulic jacks.

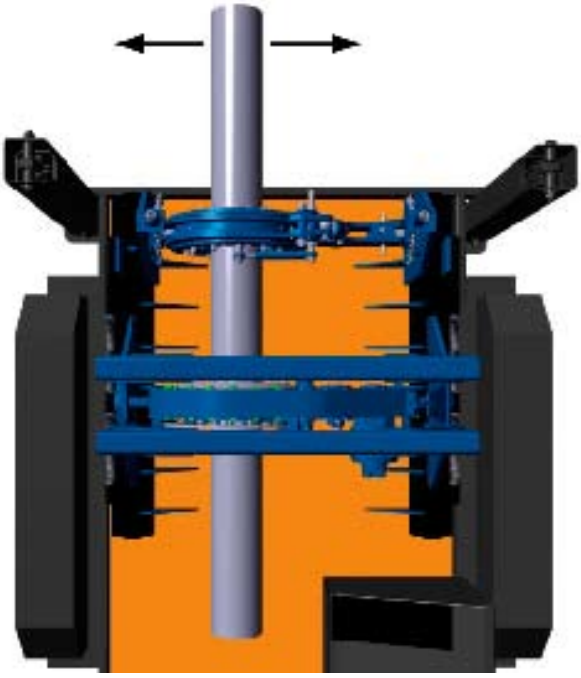
! ***ONCE THE TRAILER JACKS HAVE BEEN ADJUSTED, THE ADJUSTMENT LEVERS MUST BE LOCKED TO PREVENT ACCIDENTAL ADJUSTMENT OF JACKS.***

Ensure both ends of the pipe are supported and not allowed to deviate from the centerline. Excessive movement as indicated by the arrows in the illustration will cause increased wear on the backup guides.

(see illustration following page)



The bottom plates on all four hydraulic jacks need to be flat and secure on a stable surface before running pipe.



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Regular maintenance programs are necessary, and must be established to assure dependable and lengthy operation of your FARR Hydraulic Tong. Use the following cleaning, lubrication, and adjustment recommendations to enhance the life expectancy of the tong and assure safety of operating personnel.

A. CLEANING

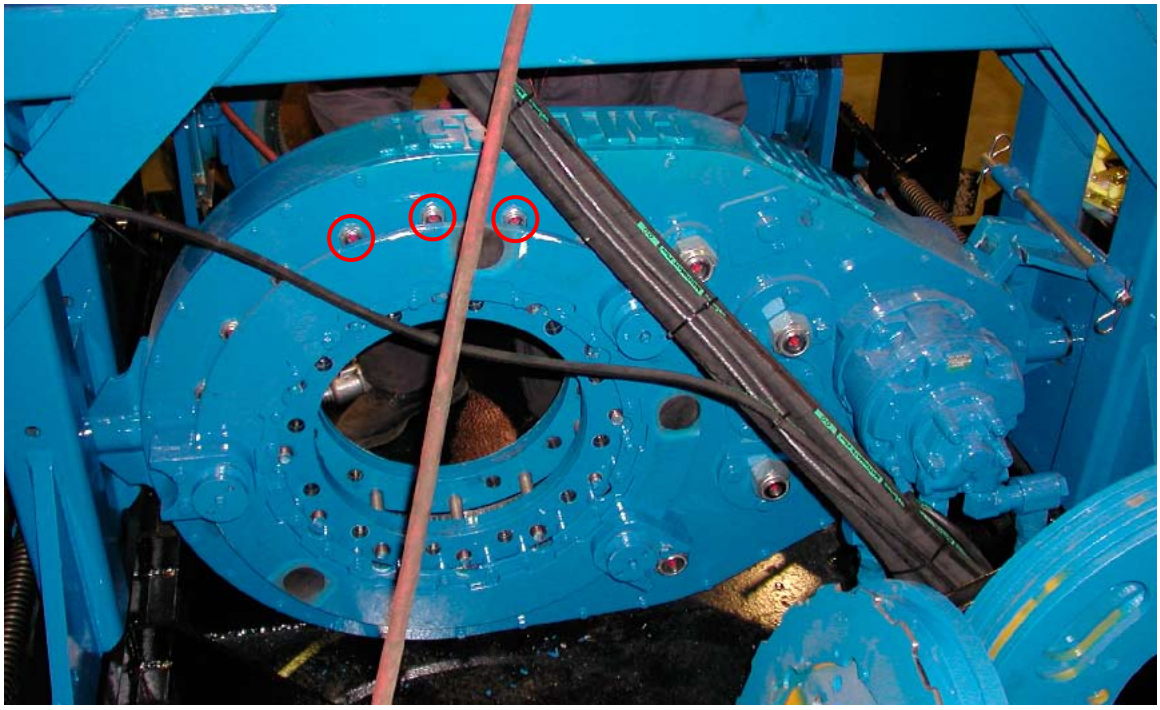
The tong should be thoroughly cleaned with a good petroleum base cleaning agent after each job, prior to storage. Farr recommends that the motor and valve assembly be periodically removed, along with the top tong plate, so that guides, rollers and gears can be properly cleaned.

B. LUBRICATION

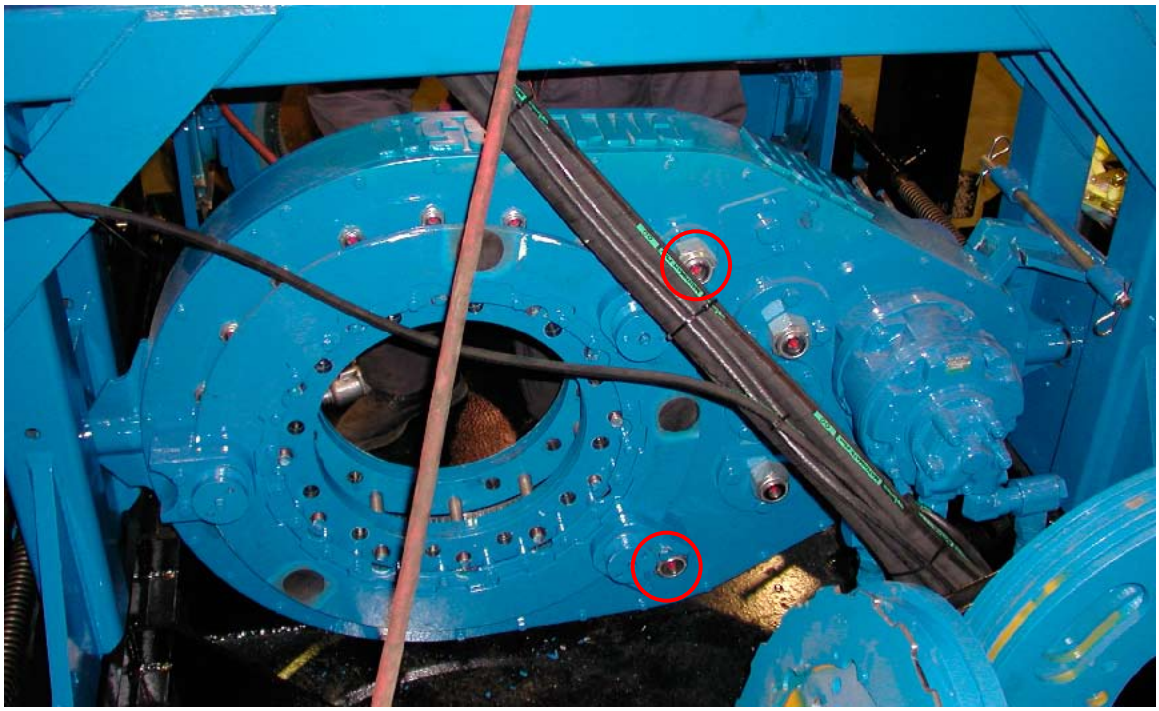
Use a quality multipurpose bearing lubricant that will remain within its viscosity range at expected operating temperatures. In addition, Farr recommends the following lubrication procedure at the completion of each job prior to storage.

1. ROTARY ROLLER BEARINGS

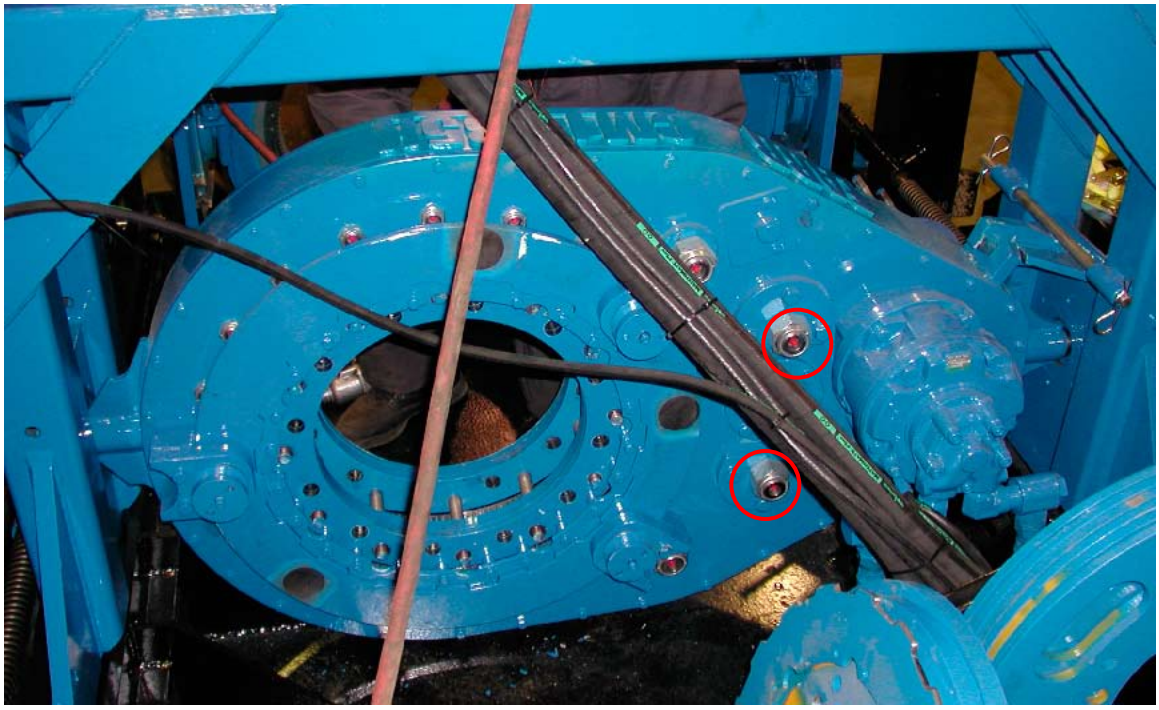
Supply grease to these bearings through the grease fittings in the ends of the rotary roller shafts, located at the top and bottom face of the tong.



2. ***ROTARY IDLER BEARINGS***
Apply grease to these bearings through the grease fittings in the ends of the rotary idler shafts, located at the top face of the tong.



3. ***PINION IDLER BEARINGS***
Apply grease to these bearings through the grease fittings in the ends of the idler half shafts, located at the top or bottom face of the tong.



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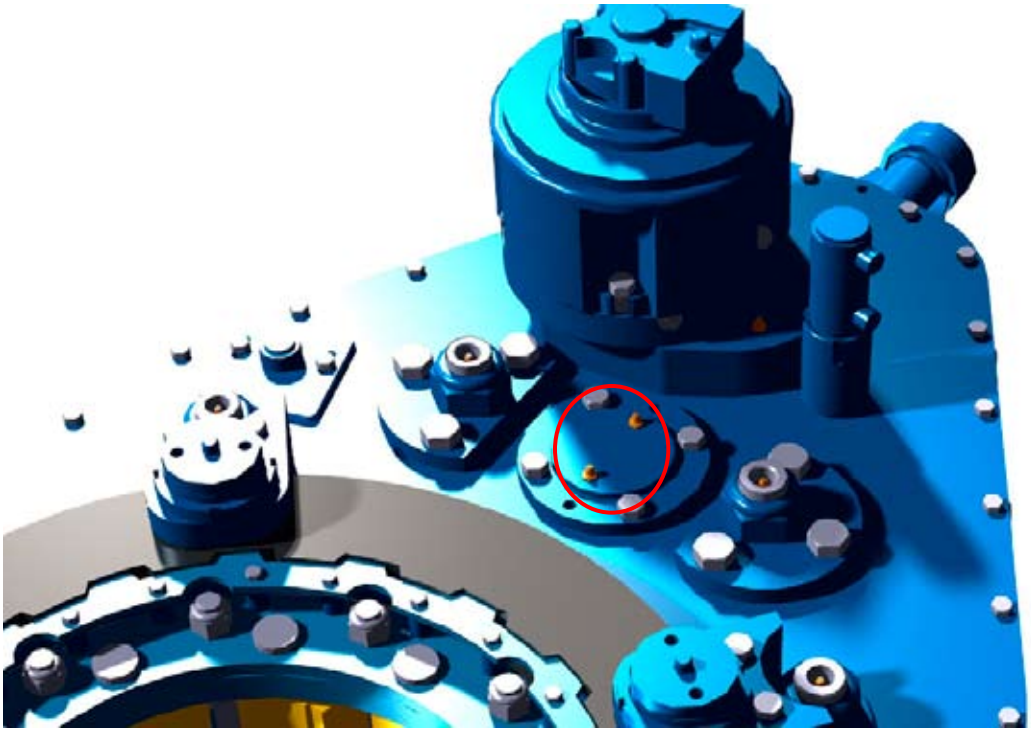
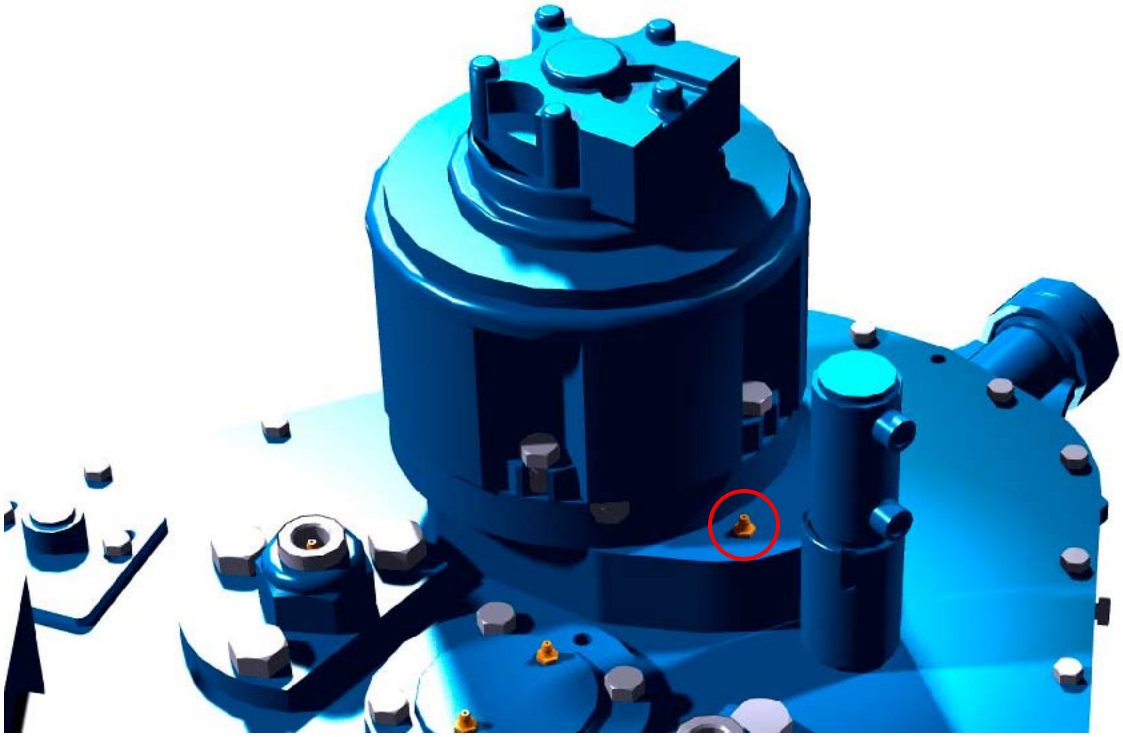
4. ***PINION BEARINGS***
Apply grease to these bearings through the grease fittings in the pinion bearing caps, which are located at the top and bottom face of the tong.

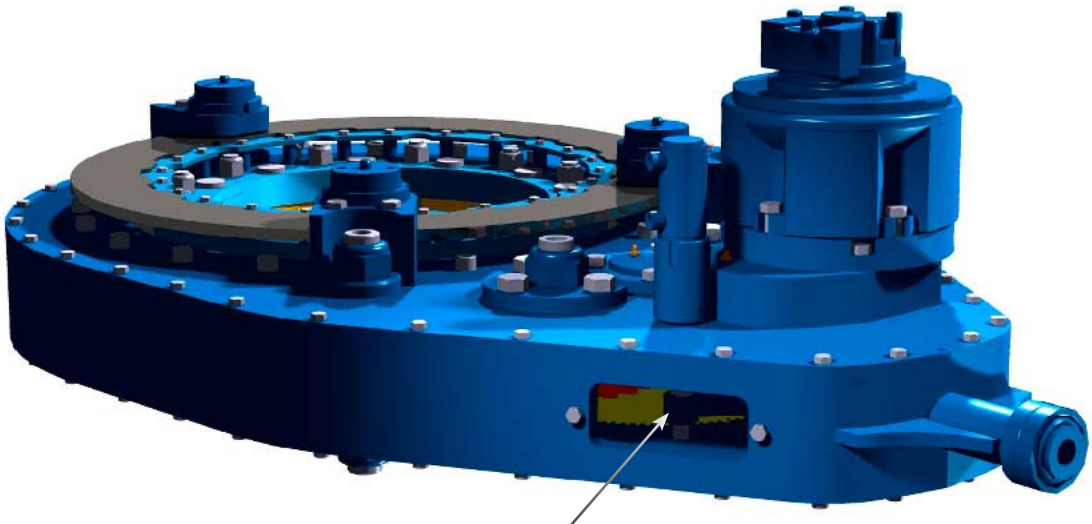


5. ***CLUTCH SHAFT BEARINGS***
Apply grease to these bearings through the grease fittings in the clutch bearing cap which is located at the bottom face of the tong.

6. ***MOTOR MOUNT HOUSING***
Apply grease to the gears in this housing through the grease fitting on top of the motor mount.



7. ***SHIFTING SHAFT BUSHINGS***
Apply grease to the shifting shaft and shifting shaft bushings, which may be accessed through the cover plate on the side of the tong.



Access shifter components through this panel

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LUBRICATION (continued...)

Recommended lubrication amount at the completion of each job:

1.	Rotary Roller Bearings (Upper and lower)	3 shots grease
2.	Rotary Idler Bearings	4 shots grease
3.	Pinion Idler Bearings	4 shots grease
4.	Pinion Bearings (Upper and lower)	2 shots grease
5.	Clutch Shaft Bearings	1 shot grease
6.	Motor Mount Housing	10 shots grease
7.	Shifting Shaft	as required

Farr recommends that the clutch inspection plate should periodically be removed, and a liberal coating of grease applied to the clutch, drive gears and shifting shaft.

C. ADJUSTMENTS

1. BRAKE ADJUSTMENT

The three manual brake calipers must be adjusted as the brake pads wear. All three calipers must be adjusted equally in order to ensure uniform wearing of the brake pads, and to ensure smooth and undeviating rotation of the brake ring.

D. RECOMMENDED PERIODIC CHECKS

1. SHIFTING SHAFT

The shifting yoke is secured to the shifting shaft by one hex jam nut and one locknut on the bottom of the yoke. Check these nuts after each job. Do this by removing the clutch inspection plate and ensuring a snug fit prior to lubrication.

2. TORQUE GAUGE ASSEMBLY

Periodic calibration of the torque gauge is recommended to assure accurate torque readings. When having the torque gauge serviced and calibrated, it is important to note the arm length of the tong, as indicated on page 2.1.

3. BRAKE PADS

Inspect brake pads regularly for cracks, chips, and excessive wear. Replace pads when wear exceeds 50% of their "new" thickness.

E. TONG OVERHAUL PROCEDURES

The tong may be overhauled using the following instructions, after removing the tong from it's frame assembly. Access to the gear train is possible by removing the top plate of the tong.

ALL MAINTENANCE AND OVERHAUL SHOULD BE PERFORMED FROM THE TOP. THEREFORE, THE BOTTOM PLATE OF THE TONG SHOULD NEVER BE REMOVED FROM THE GEAR CASE HOUSING.

1. *Securely support tong from the bottom using sturdy stands.*
2. *Remove the two 1/2" hex bolts securing the three brake assemblies to the top plate of the tong (six bolts total).*
3. *Remove the brake ring.*
4. *Use the 24 hex bolts securing the cageplate - brake connector ring, and remove the connector ring and the 24 spacers.*
5. *Remove the anchor pins from the 12 jaw die pins, and remove the pins and jaw dies.*

! **THE CAGE PLATE BOLTS ARE THE ONLY ITEMS FASTENING THE BOTTOM CAGE PLATE TO THE TONG. SUPPORT THE BOTTOM CAGE PLATE FROM BELOW PRIOR TO REMOVING CAGE PLATE BOLTS IN ORDER TO PREVENT DAMAGE TO THE BOTTOM CAGE PLATE OR PERSONAL INJURY TO THE MECHANIC**

6. *Remove the twelve 3/4" nylock nuts from the cageplate bolts on the bottom side of the tong. Take care to support the bottom cageplate and cageplate spacer while removing the last couple of nuts.*
7. *Remove the sixteen 7/8" nylock jam nuts from the top side of the support rollers.*
8. *Remove the motor assembly as follows:*
   a. *Remove the five 1/2" bolts which secure the motor to the auxilliary motor mount.*
   b. *Lift off the motor assembly. Inspect the motor gear, located at the bottom of the motor shaft, for gear excessive gear backlash or tooth damage. Ensure that the motor gear is securely attached to the motor shaft.*
9. *Remove the auxilary motor mount and the motor mount by removing the four 1/2" socket head cap screws. Lift the mounts out of place.*
10. *Remove the snap ring, allowing disassembly of the top clutch gear.*
11. *Pull the top bearing cap and spacer for the pinion drive gear by removing the four 1/2" bolts which secure the bearing cap. Thread two of the removed bolts into the extra holes on top of the bearing cap, and use them as lifting lugs to lift the bearing cap out of place.*

* **IF THE BEARING REMAINS ATTACHED TO THE GEAR SHAFT AFTER THE BEARING CAP IS PULLED, FARR SERVICE PERSONNEL RECOMMENDS LEAVING IT IN PLACE UNTIL THE TOP TONG PLATE IS REMOVED.**

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12. *Remove the top clutch bearing retainer which is secured by two or three countersunk socket head screws.*
13. *Remove the three hex bolts securing each pinion idler pad to the top plate of the tong.*
14. *Remove the nylock nuts and pads for the rotary and pinion idler gears.*
15. *Remove the inspection plate at the rear side of the tong. Disconnect shifting shaft from shifting fork.*
16. *Remove shifter assembly.*
17. *Remove the 3/8" socket head cap screws around the perimeter of the tong.*
18. *The top tong plate can be lifted off providing access to the inside of the gear case.*

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Adequate maintenance and proper fluid selection should keep hydraulic problems to a minimum. If troubleshooting is necessary, ensure that the technician is well-trained in hydraulic systems, and familiar with the equipment design, assembly and operation. Knowledge of hydraulic circuits and components is essential in isolating trouble areas and pinpointing particular faults.

The following troubleshooting guidelines are intended to be general in nature. Any faults not solved through the use of this guide should be referred to our engineering department for their evaluation and recommendations.

A. PUMP MAKES EXCESSIVE NOISE

1. *POSSIBLE PROBLEM: Plugged or restricted intake line.*
   SOLUTION: Clean intake line.

2. *POSSIBLE PROBLEM: Plugged reservoir air vent.*
   SOLUTION: Clean or replace.

3. *POSSIBLE PROBLEM: Fluid viscosity too high due to ambient temperature.*
   SOLUTION: Replace fluid with a type that maintains the proper viscosity range in the operating environment.

4. *POSSIBLE PROBLEM: Air leaking into system.*
   SOLUTION: Ensure oil pickup is well below oil surface level in reservoir. Check pump packing and line connections on intake side by pouring oil over the suspected leak. If the noise stops, the leak has been located. Tighten joints or change packing or gaskets where necessary.

5. *POSSIBLE PROBLEM: Loose or worn parts.*
   SOLUTION: Replace parts. NOTE: Improper selection of hydraulic fluid may result in premature wear.

6. *POSSIBLE PROBLEM: Pump misalignment with motor.*
   SOLUTION: Check alignment.

7. *POSSIBLE PROBLEM: Pump running in excess of rated speed.*
   SOLUTION: Check manufacturer's recommended speed. Check pulleys, gears, power take-off, or drive motor.

B. HYDRAULIC SYSTEM OVERHEATING

1. *POSSIBLE PROBLEM: Excess discharge pressure (relief valve set too high).*
   SOLUTION: Reset relief valve in accordance with maximum pressure required. Check manufacturer's recommendations.

2. *POSSIBLE PROBLEM: Fluid viscosity too high or too low due to extreme ambient temperatures.*
   SOLUTION: Replace fluid. (Check pump and motor manufacturer's recommendations.)

3. *POSSIBLE PROBLEM: Excessive internal leakage.*
   SOLUTION: Repair or replace any worn parts (loose packing, etc.)

4. *POSSIBLE PROBLEM: Excessive friction.*
   SOLUTION: Check pump for part interference. Pump may be assembled too tightly.

5. *POSSIBLE PROBLEM: Leaks in pump check valve or relief valve.*
   SOLUTION: Repair or replace.

6. *POSSIBLE PROBLEM: Fluid level in reservoir too low for proper cooling.*
   SOLUTION: Maintain proper oil level.

7. *POSSIBLE PROBLEM: Pump discharge being restricted.*
   SOLUTION: Check operation of throttle valve. Check relief valve. Do not allow larger pump volumes to remain at high pressure for long periods of time. Check all self-sealing hose connections for proper engagement.

8. *POSSIBLE PROBLEM: Hydraulic system valves restricted.*
   SOLUTION: Clean valves and piping.

9. *POSSIBLE PROBLEM: Heat exchanger not cooling hydraulic fluid.*
   SOLUTION:
   - *Hydraulic circuit through heat exchanger is obstructed.*
   - *Cooling coils in heat exchanger may be coated with a layer of dust.*
   - *Airflow through heat exchanger may be obstructed.*
   - *Cooling fan may be malfunctioning*

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C. EXCESSIVE WEAR OF MOVING PARTS

1. *POSSIBLE PROBLEM: Abrasive contaminants entrained in the fluid.*
   SOLUTION: Change fluid more frequently. Replace filter element. Be sure filter is proper size.

2. *POSSIBLE PROBLEM: Misalignment of moving parts.*
   SOLUTION: Inspect and realign.

3. *POSSIBLE PROBLEM: Operating pressure rises above manufacturer's recommendations.*
   SOLUTION: Check relief valve and reset.

4. *POSSIBLE PROBLEM: Viscosity of fluid too low at working temperature.*
   SOLUTION: Ensure fluid is compatible with operating temperature.

5. *POSSIBLE PROBLEM: Air in system.*
   SOLUTION: Bleed air and check for leaks in system.

6. *POSSIBLE PROBLEM: Excessive wear of bearings.*
   SOLUTION: Inspect alignment of moving parts, vibration or excessive side thrusts on shafts.

D. TONG RUNNING T00 SLOWLY

1. *POSSIBLE PROBLEM: Pump intake line plugged.*
   SOLUTION: Clean intake line.

2. *POSSIBLE PROBLEM: Reservoir oil level too low.*
   SOLUTION: Add oil.

3. *POSSIBLE PROBLEM: Air leak in pump intake line.*
   SOLUTION: Repair leak.

4. *POSSIBLE PROBLEM: Pump speed too slow.*
   SOLUTION: Check manufacturer's speed recommendations.

5. *POSSIBLE PROBLEM: Excessively worn or damaged pump or tong.*
   SOLUTION: Replace worn parts by following manufacturer's recommendations.

6. *POSSIBLE PROBLEM: Fluid viscosity too high.*
   SOLUTION: Some pumps will not prime if the fluid is too heavy.

* **BYPASS ALL TONG CIRCUITRY TO TEST PRESSURE AND VOLUME. IF FLOW AND PRESSURE ARE TESTED OFTEN, FARR RECOMMENDS CONSTRUCTION OF A TEST RIG THAT CAN EASILY BE CONNECTED TO THE PUMP SUCTION AND DISCHARGE PORTS**

7. *POSSIBLE PROBLEM: Restriction in line between power unit and tong.*
   SOLUTION: Check self-sealing couplings to insure they are properly engaged.

8. *POSSIBLE PROBLEM: By-pass valve not functioning.*
   SOLUTION: Check and repair.

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E. TONG WILL NOT DEVELOP SUFFICIENT TORQUE

1. *Malfunctioning relief valve on unit or tong.*

   a. *POSSIBLE PROBLEM: Relief pressure set too low.*
   SOLUTION: Increase setting. To check, block the oil line beyond the relief valve and determine pressure with a gauge.

   b. *POSSIBLE PROBLEM: Valve is stuck.*
   SOLUTION: Check for contamination of oil that may inhibit the way the valve actuates. Remove valve and clean, ensuring that the valve spring operates smoothly.

   c. *POSSIBLE PROBLEM: Valve is leaking.*
   SOLUTION: Check valve seat for scouring. Check oil seals. Check for particles stuck under the valve system.

2. *POSSIBLE PROBLEM: Worn or damaged pump parts.*
   SOLUTION: Inspect and clean, replace all worn or broken parts.

3. *POSSIBLE PROBLEM: Pump speed too slow.*
   SOLUTION: Check motor speed.

4. *POSSIBLE PROBLEM: Fluid viscosity too high.*
   SOLUTION: Pump may not prime if fluid is too heavy. Replace with proper viscosity fluid.

5. *POSSIBLE PROBLEM: Viscosity of fluid too low.*
   SOLUTION: System may overheat. Replace with proper viscosity fluid.

6. *POSSIBLE PROBLEM: Fluid by-passed to reservoir.*
   SOLUTION: Check relief valve for proper operation. Check directional valve. Neutral position should return fluid directly to the reservoir.

7. *POSSIBLE PROBLEM: Worn or damaged tong motor causing slippage.*
   SOLUTION: Replace or repair worn or damaged parts.

8. *POSSIBLE PROBLEM: Damaged bearings or gears causing excessive drag.*
   SOLUTION: Repair or replace worn parts.

9. *POSSIBLE PROBLEM: Poor hydraulic pressure at the tong or excessive back pressure in the return line.*
   SOLUTION: Restriction in line between power unit and tong. Inspect integrity of self-sealing couplings.

10. *POSSIBLE PROBLEM: Defective torque gauge or load cell.*
    SOLUTION: Replace defective components. Ensure dampening screw has been adjusted. Ensure gauge has been calibrated to proper torque arm length.

F. FAILURE OF JAWS TO GRIP PIPE

1. *POSSIBLE PROBLEM: Dies have become too dull.*
   SOLUTION: Replace dies.

2. *POSSIBLE PROBLEM: Brake band insufficiently adjusted, not allowing jaws to cam properly.*
   SOLUTION: Adjust brake bands to give proper resistance to cage plates.

3. *POSSIBLE PROBLEM: Jaw roller broken or worn.*
   SOLUTION: Replace roller.

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G. FAILURE OR DIFFICULTY OF TONG TO SHIFT

1. *POSSIBLE PROBLEM: Bent or broken shifter handle.*
   SOLUTION: Replace shifter handle.

2. *POSSIBLE PROBLEM: Bent or broken shifter yoke.*
   SOLUTION: Inspect and replace shifter yoke.

3. *POSSIBLE PROBLEM: "Frozen" or hard-to-move shifter handle.*
   SOLUTION: Grease shifter shaft through grease zert.

4. *POSSIBLE PROBLEM: Bent shifter shaft.*
   SOLUTION: Replace.

5. *POSSIBLE PROBLEM: Tong pops out of gear*
   SOLUTION: Ensure that detent ball & spring assembly has been correctly set.

H. GENERAL COMMENTS

The following factors contribute highly to inefficient hydraulic operation:

1. *Failure to change fluid frequently enough, or inadequate fluid filtration.*
2. *Unsuitable hydraulic fluid.*
3. *Defective packing or seals in components of the hydraulic system.*
4. *Poor or incomplete understanding of hydraulic system components and/or operation of the equipment.*

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A. Store tong in a clean, dry, ventilated area.

B. Ensure adequate lubrication before placing in storage (See lubrication section of manual).

C. Coat spare moving parts (gears, shafts, etc.) with a good corrosion inhibitor if required to remain in storage for long periods of time. Store parts in a clean, dry area.

D. Store all o-rings, seals, packings, gaskets, etc. in strong moisture proof, airtight containers. Ensure that these items are not crushed, nicked, or otherwise damaged.

E. Generously lubricate all bearings (cam followers, roller bearings, etc.) and store in a dust-free box or container, protected from moisture.

IF PROTECTED STORAGE OF THE TONG IS NOT AVAILABLE (FOR EXAMPLE, FORCED STORAGE OUTSIDE ON A DRILL SITE IN DUSTY CONDITIONS), FARR RECOMMENDS TAKING THE FOLLOWING STEPS:

1. Generously apply grease to all fittings so that excess grease pumped through bearings acts as a seal against dust.

2. Cover or wrap tong with tarp or plastic to prevent wind-blown dust from getting into gears. If a tong has been exposed to extreme dust conditions, Farr recommends following these instructions before use:

    1. Suspend tong by body lug, remove clutch inspection plate and thoroughly wash & flush interior with solvent, diesel fuel or equivalent.
    2. Attach hydraulic hose and slowly rotate rotary gear, washing teeth of rotary and idler gears as they become exposed.
    3. Wash all sand and grit from cam follower grooves in rotary and cage plates.
    4. Wash and lubricate exposed end of shifting shaft.
    5. Wash and lightly grease cam surfaces of rotary gear.
    6. Grease teeth of rotary gear.
    7. Give every grease nipple a few shots of grease to displace any grit or sand which may have remained in bearings.

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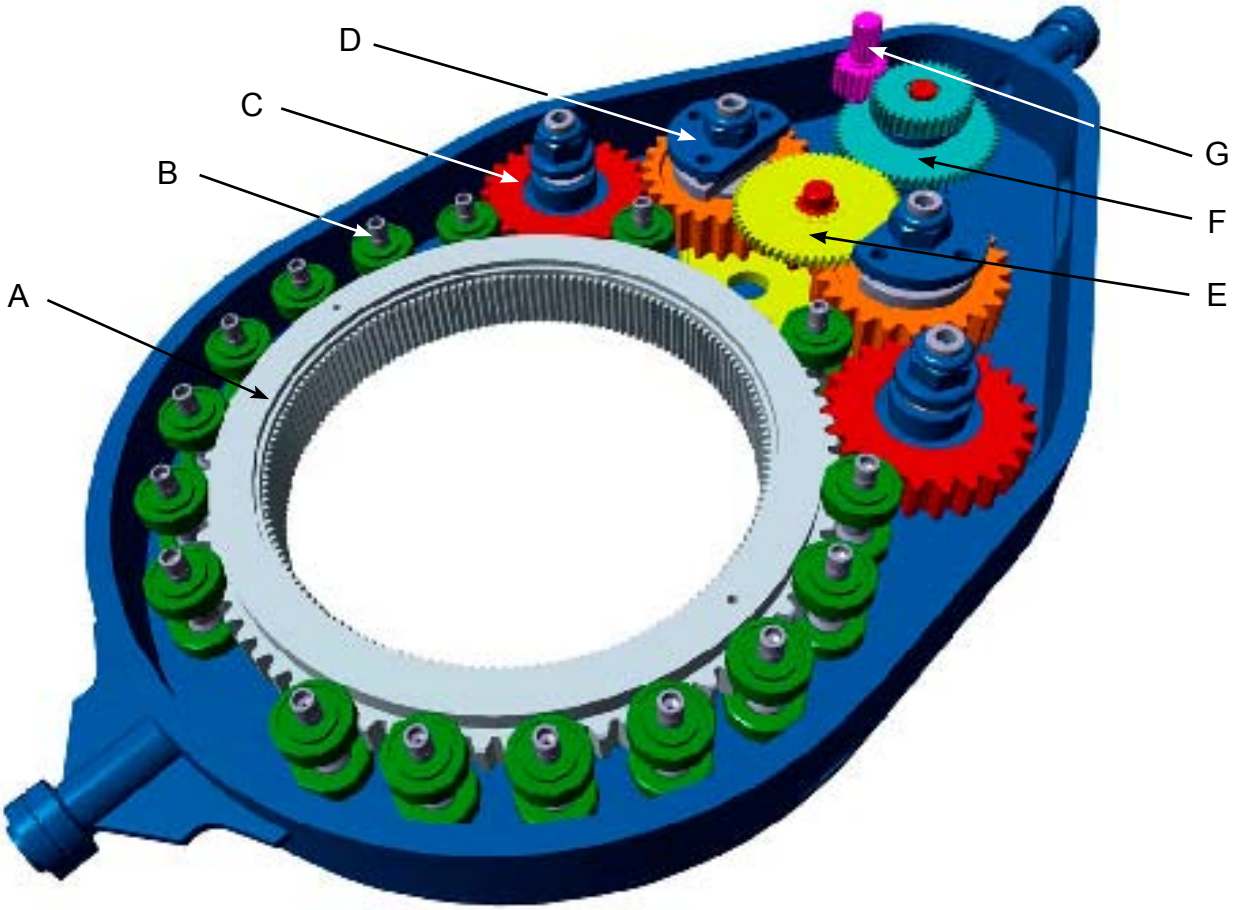
Assemblies And Parts Lists



ISO View

TOP View

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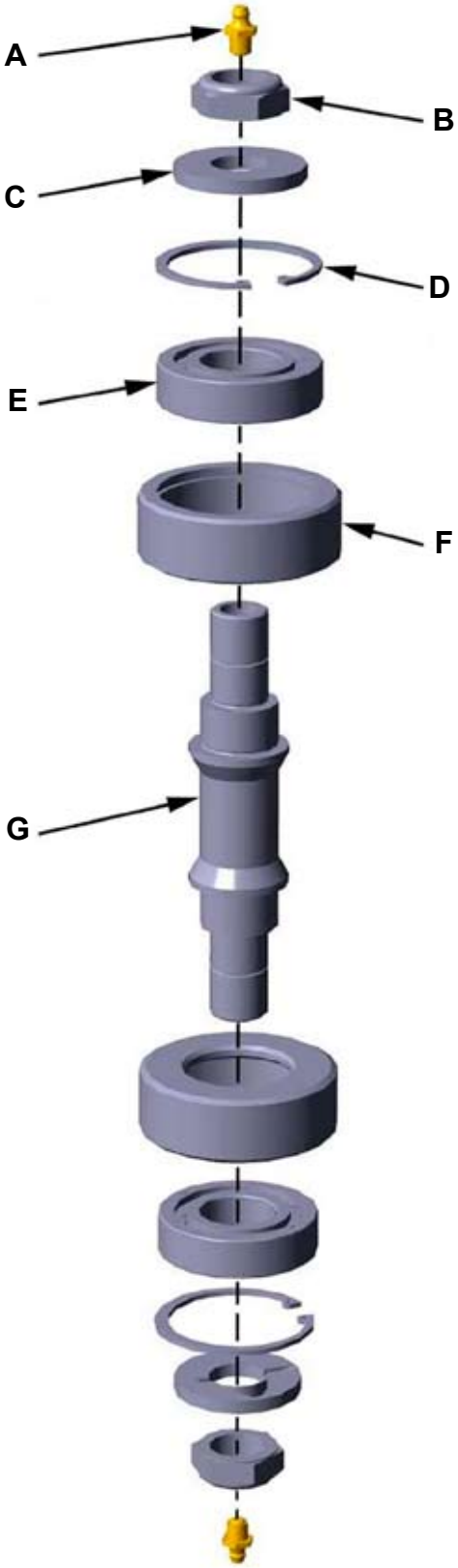
Item	Type	Description	Qty	Part Number
A	Part	Rotary Gear	1	AQ01-001
B	Assembly	Support Rollers	16	AQ03-100 (Page 7.4)
C	Assembly	Rotary Idlers	2	AQ01-100 (Page 7.10)
D	Assembly	Pinion Idlers	2	AQ01-120 (Page 7.8)
E	Assembly	Pinion	1	AQ01-150 (Page 7.6)
F	Assembly	Clutch	1	AQ01-200 (Page 7.12)
G	Part	Motor Gear	1	997-151-04



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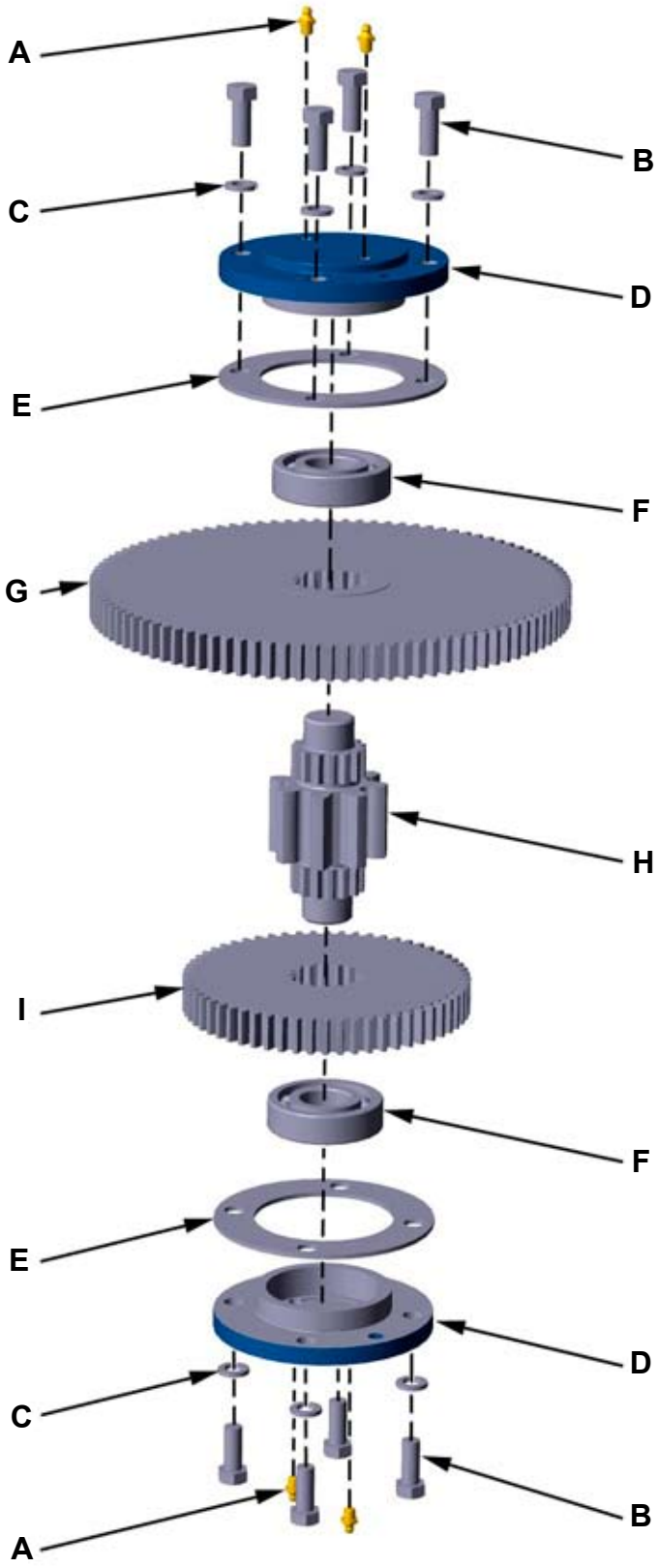
Item	Type	Description	Qty	Part Number
	Assembly	Support Rollers	16	AQ03-100
A	Part	Grease Fitting	2	02-0097
B	Part	7/8"-UNF Jam Nut	2	09-5722
C	Part	Roller Cap Spacer	2	997D21-140
D	Part	Bearing Retainer Ring	2	02-0013
E	Part	Bearing MU1206UM	2	02-0014
F	Part	Roller Cap	2	997-D21-135
G	Part	Roller Shaft	1	997-D21-131



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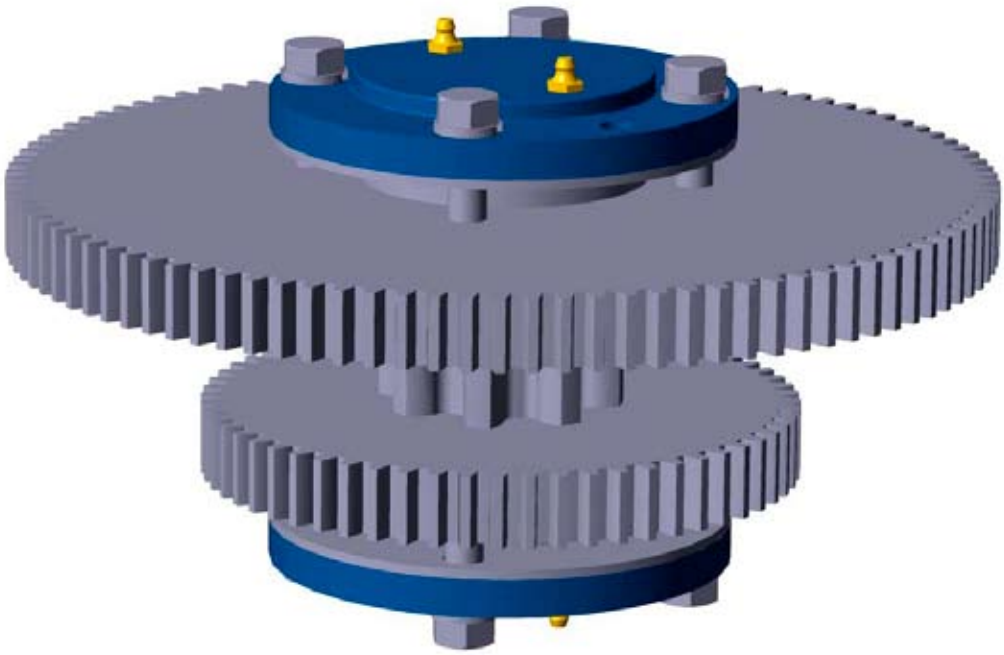
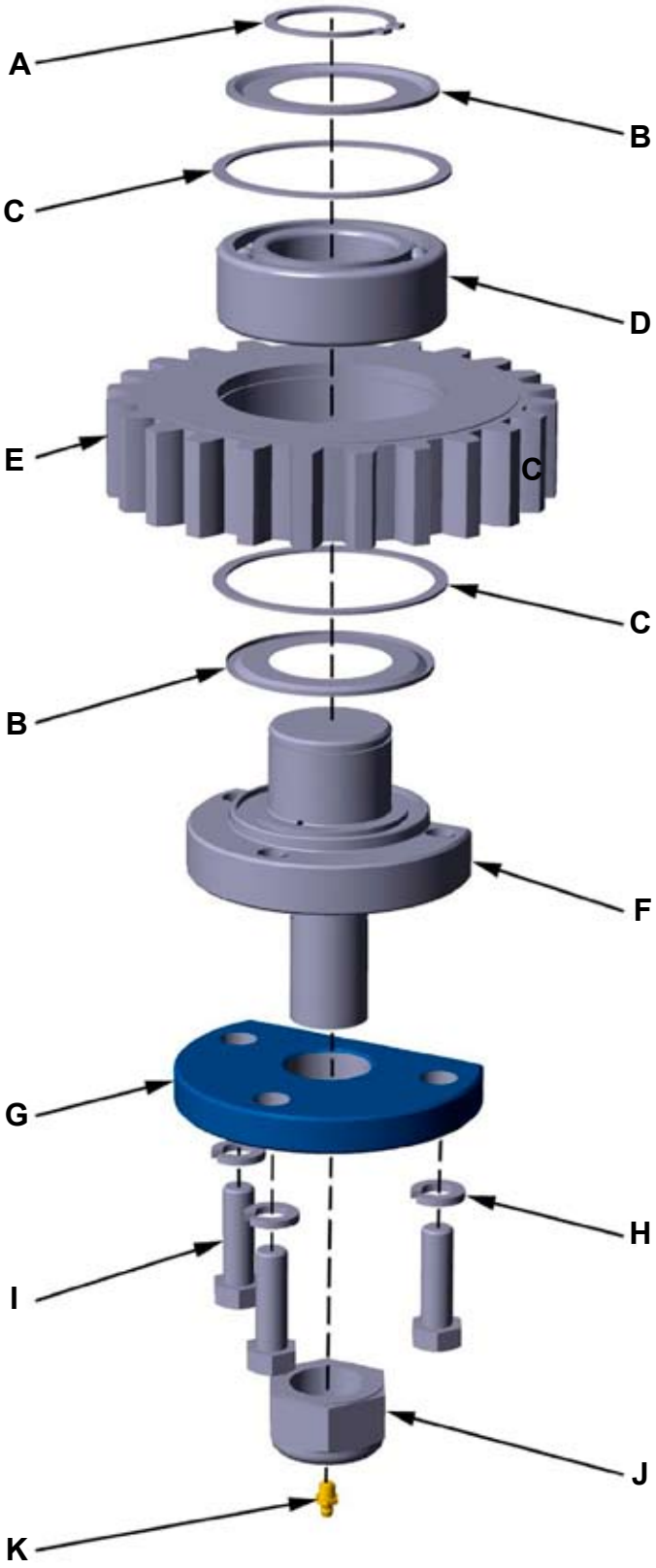


Item	Type	Description	Qty	Part Number
	Assembly	Pinion	1	AQ01-150
A	Part	Grease Fitting	4	02-0097
B	Part	1/2" NC x 1-1/4" hex bolt	8	09-1168
C	Part	1/2" lock washer	8	09-5110
D	Part	Pinion Bearing Cap	2	997-89
E	Part	Pinion Bearing Spacer	2	1400-89A
F	Part	Bearing	2	NSK6307
G	Part	Low Pinion Gear	1	997-A5-88
H	Part	Pinion Gear	1	997-A7-86B
I	Part	High Pinion Gear	1	997-A4-87B



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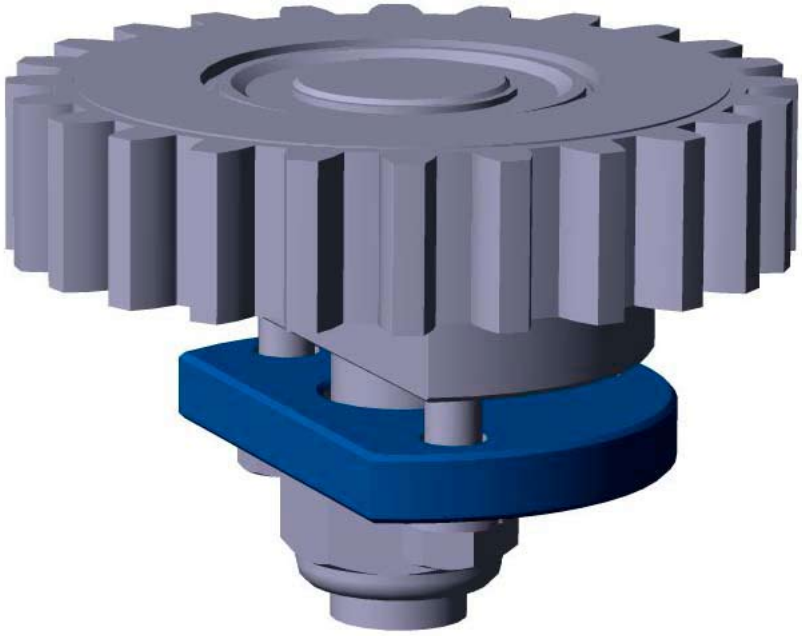
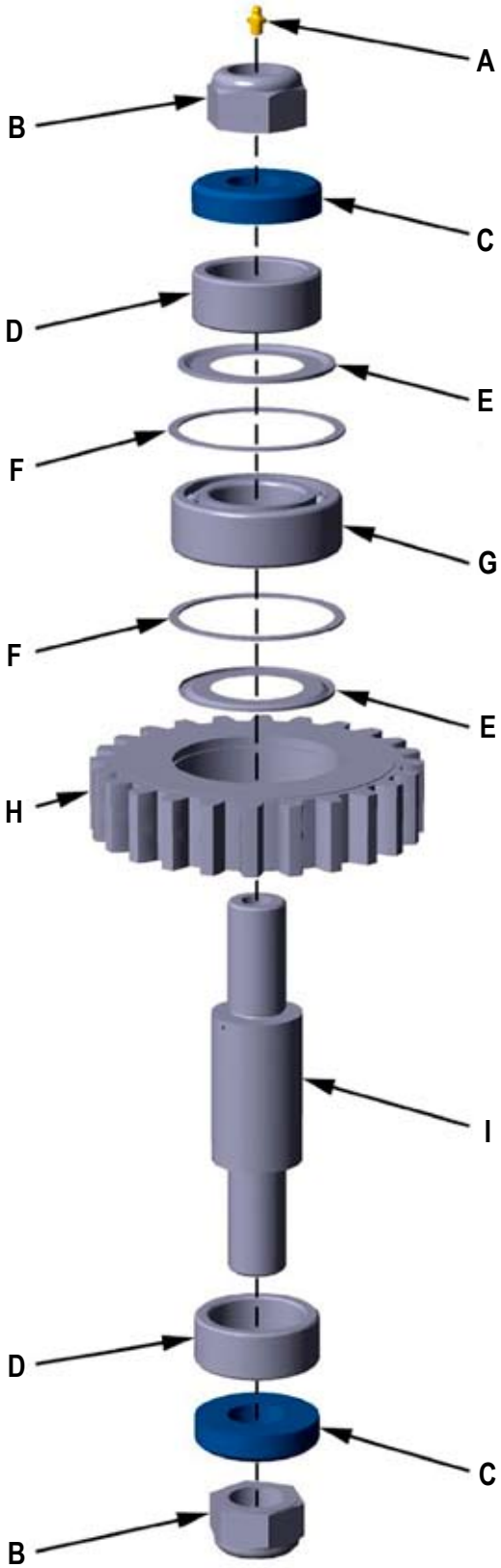


Item	Type	Description	Qty	Part Number
	Assembly	Pinion Idler Assembly	1	AQ01-120
A	Part	Bearing Retainer Ring	1	02-0008
B	Part	Pinion Idler Bearing Seal	2	02-0010
C	Part	Pinion Idler Gear Retainer	2	02-0009
D	Part	Bearing	1	02-0011
E	Part	Pinion Idler Gear	1	997-A2-119B
F	Part	Idler Half Shaft	1	997-D17-105
G	Part	Pinion Idler Pad	1	1400-109
H	Part	5/8" Lock Washer	3	09-5114
I	Part	5/8"-NC x 2" hex bolt	3	09-1234
J	Part	1-1/2" Nylock Nut	1	09-5840
K	Part	Grease Fitting	1	02-0097



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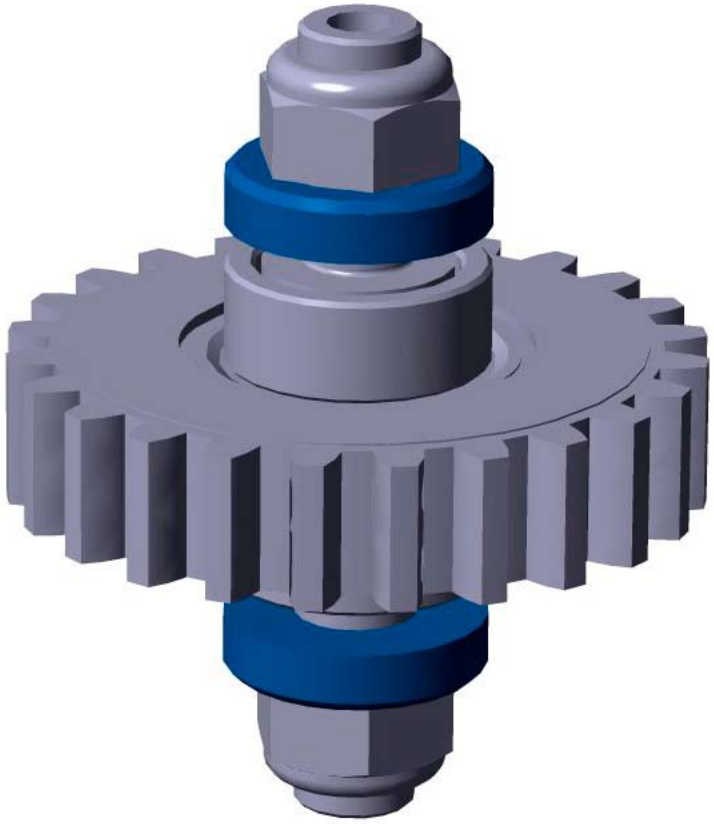
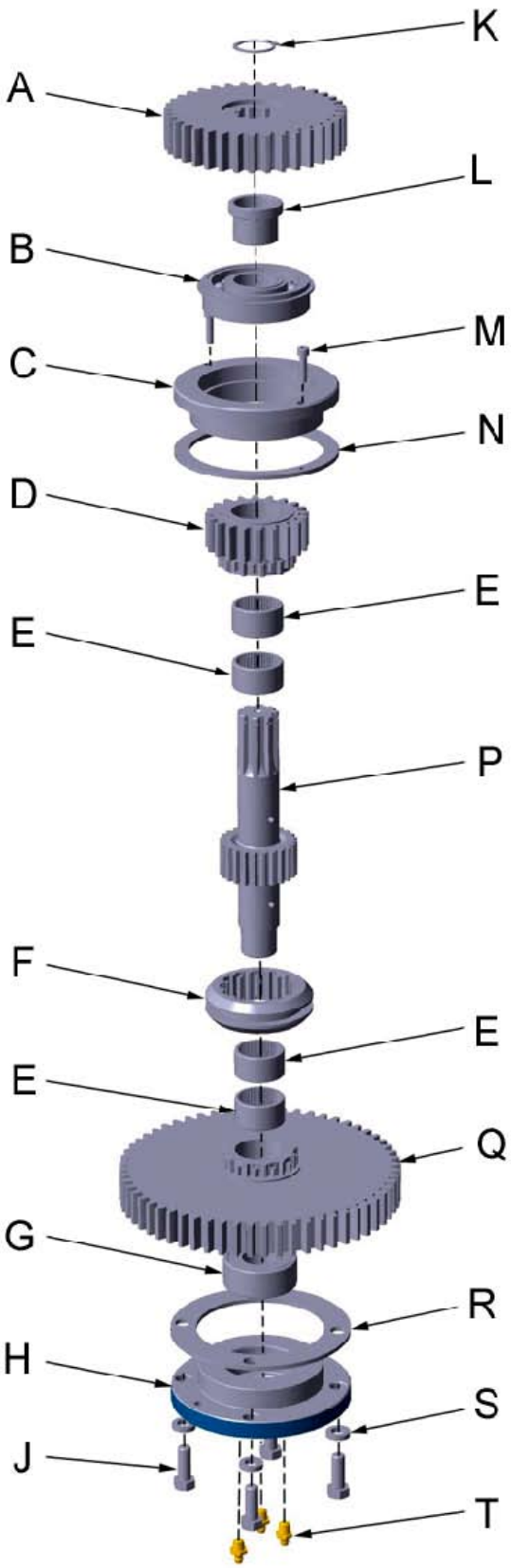


Item	Type	Description	Qty	Part Number
	Assembly	Rotary Idler Assembly	1	AQ01-100
A	Part	Grease Fitting	1	02-0097
B	Part	1-1/2" Nylock Nut	2	09-5840
C	Part	Rotary Idler Pad	2	1400-125
D	Part	Bearing Spacer	2	997-D20-121
E	Part	Bearing Seal	2	997-A2-119B
F	Part	Rotary Idler Gear Retainer	2	02-0011
G	Part	Rotary Idler Bearing	1	1400-109
H	Part	Rotary Idler Gear	1	997-A2-119C
I	Part	Rotary Idler Shaft	1	997-D19-117



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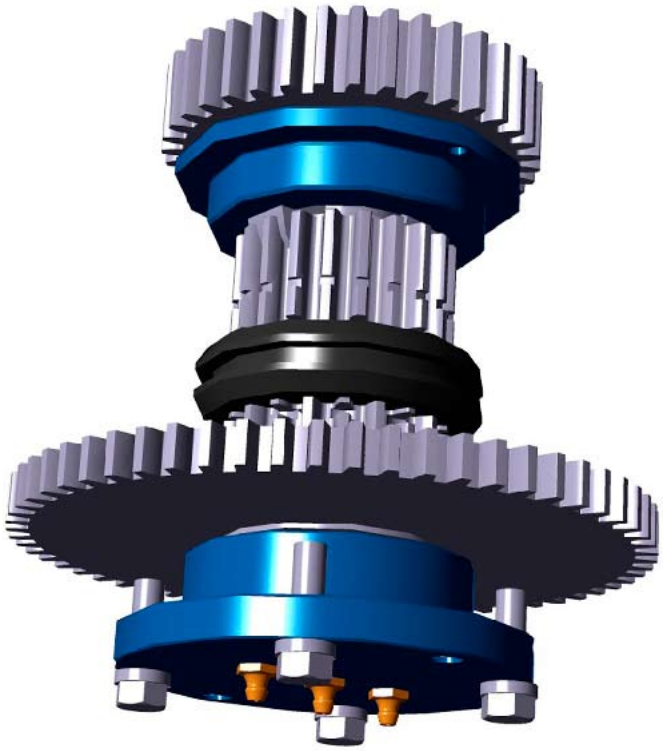
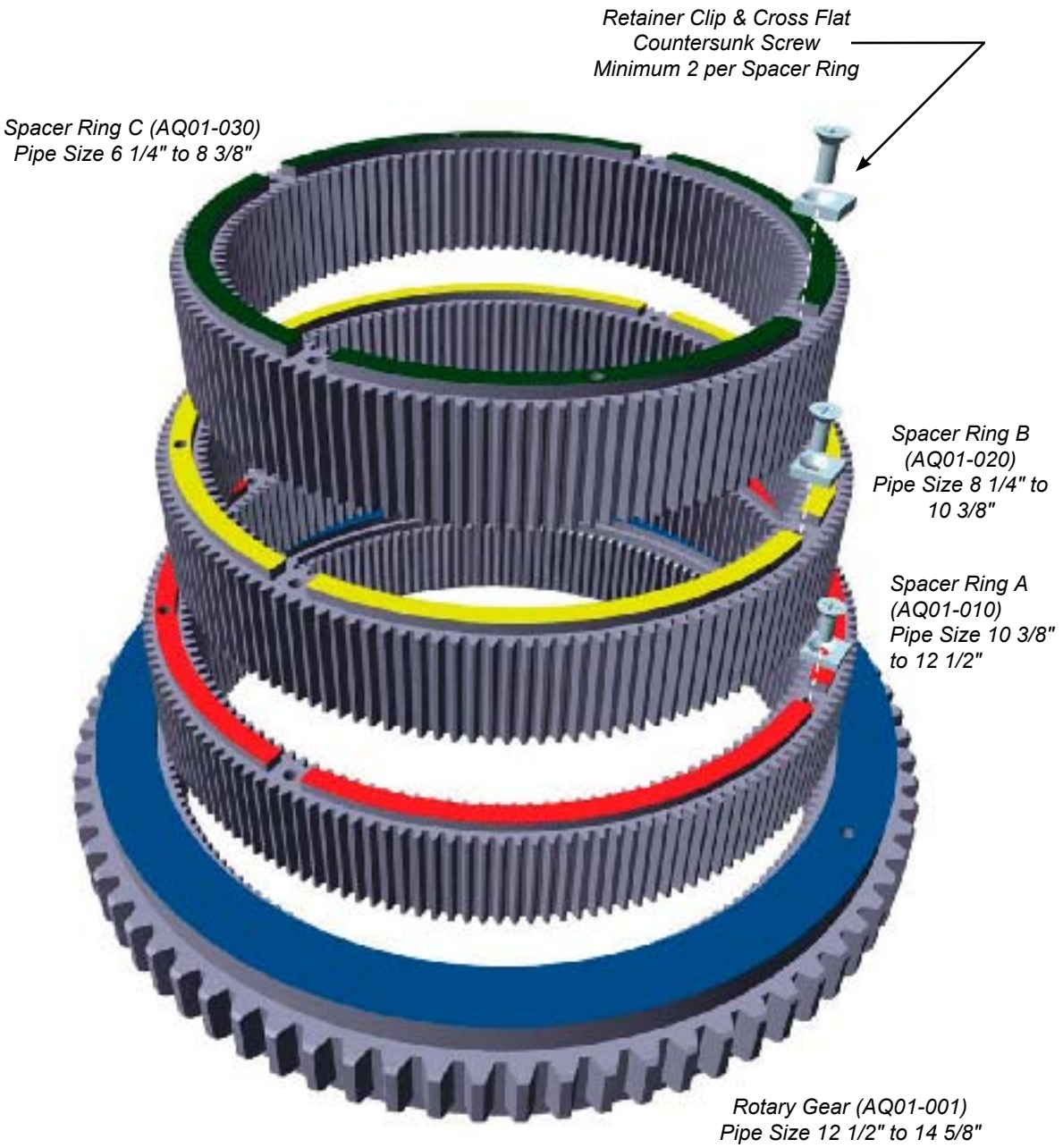


Item	Type	Description	Qty	Part Number
	Assembly	Clutch	1	AQ01-200
A	Part	Drive Gear	1	997-HT-61
B	Part	Top Clutch Bearing	1	02-0002
C	Part	Bearing Retainer	1	997-HT-59
D	Part	Low Clutch Gear	1	997-HT-52
E	Part	Clutch Gear Bearing	4	02-0003
F	Part	Shifting Collar	1	997-HT-62
G	Part	Bottom Clutch Bearing	1	02-0004
H	Part	Bottom Clutch Bearing Cap	1	997-HT-54
J	Part	3/8"-NC x 1" hex bolt	4	09-1046
K	Part	Retainer Ring	1	02-0001
L	Part	Top Clutch Bearing Bushing	1	997-HT-60
M	Part	No. 10 x 3/4" Cap Screw	2	
N	Part	Clutch Shaft Bearing Retainer	1	1400-59a
P	Part	Splined Shaft	1	997-HT-50
Q	Part	High Clutch Gear	1	997-HT-51B
R	Part	Clutch Bearing Spacer	1	1400-54A
S	Part	3/8" Lock Washer	4	09-5106
T	Part	Grease Fitting	1	02-0097
Not Shown		Motor Gear	1	997-A10-149


Retainer Clip & Cross Flat Countersunk Screw Minimum 2 per Spacer Ring
Spacer Ring C (AQ01-030) Pipe Size 6 1/4" to 8 3/8"
Spacer Ring B (AQ01-020) Pipe Size 8 1/4" to 10 3/8"
Spacer Ring A (AQ01-010) Pipe Size 10 3/8" to 12 1/2"
Rotary Gear (AQ01-001) Pipe Size 12 1/2" to 14 5/8"

Rotary Gear & Inserts

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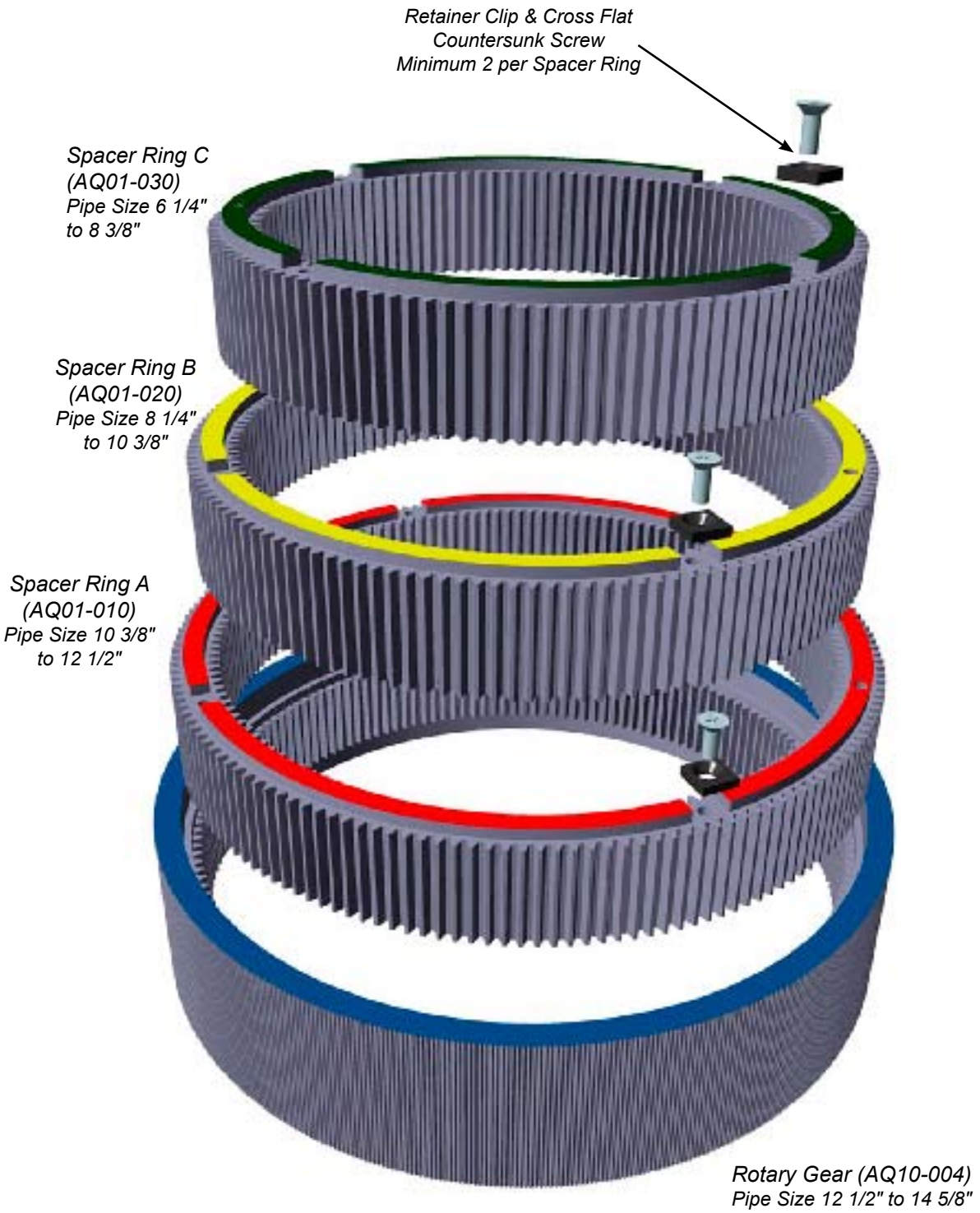

RINGS REQUIRED	NUMBER OF JAWS	PIPE RANGE USE DIE SIZE 5 TO 4	PIPE RANGE USE DIE SIZE 4-1/2 TO 3-1/2	PIPE RANGE USE DIE SIZE 3-1/2 TO 2-7/8
MASTER RING BLUE PLATES	**Standard Jaw 12**	**OD 13-5/8 to 14-5/8**	**OD 13-1/8 to 14-1/8**	**OD 12-1/2 to 13-1/8**
	Long Jaw 6	**OD 12 to 12-1/2**	**OD 11-5/8 to 12-1/8**	**OD 11 to 11-1/2**
RING A RED PLATES	**Standard Jaw 10**	**OD 11-1/2 to 12-1/2**	**OD 11 to 12**	**OD 10-3/8 to 11**
	Long Jaw 5	**OD 10-1/4 to 11-1/2**	**OD 9-3/8 to 10**	**OD 8-7/8 to 9-1/2**
RING B YELLOW PLATES	**Standard Jaw 8**	**OD 9-3/8 to 10-3/8**	**OD 8-7/8 to 9-7/8**	**OD 8-1/4 to 8-7/8**
	Long Jaw 4	**OD 7-3/8 to 8-1/8**	**OD 7-1/8 to 8**	**OD 6-1/2 to 7-3/8**
RING C GREEN PLATES	**Standard Jaw 7**	**OD 7-3/8 to 8-3/8**	**OD 6-7/8 to 7-7/8**	**OD 6-1/4 to 6-7/8**
	Long Jaw 7	**OD 5-3/8 to 6-1/4**	**OD 5 to 5-7/8**	**OD 5-3/8 to 4-5/8**

EACH PIPE SIZE REQUIRES A RING AND 5 PLATES FOR THE TONG AND 4 PLATES FOR THE BACKUP, EXCEPT FOR THE 13-5/8 AND ABOVE, WHICH USES THE MASTER RING IN THE TONG AND BACKUP WITH APPLICABLE DIES

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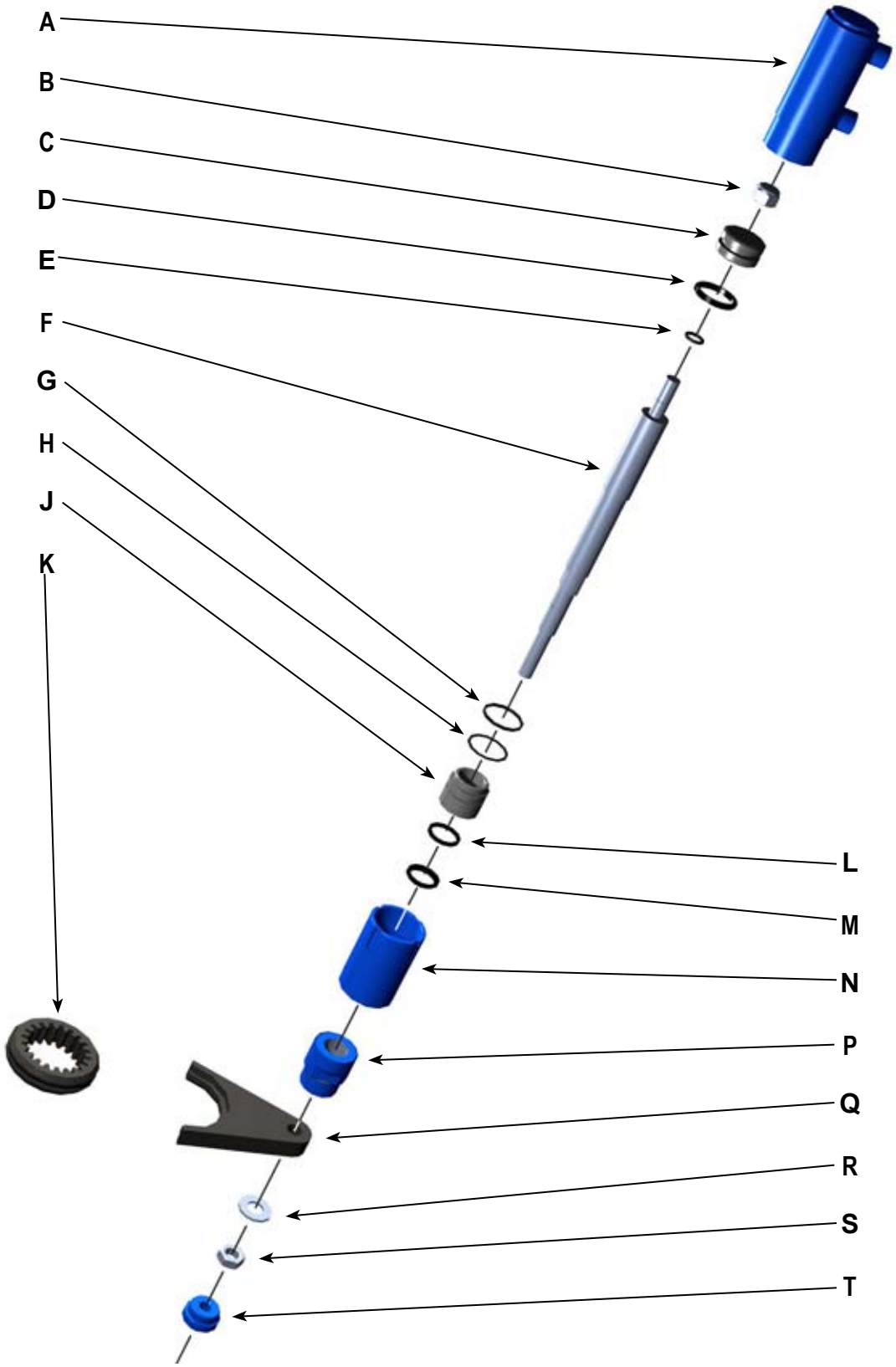

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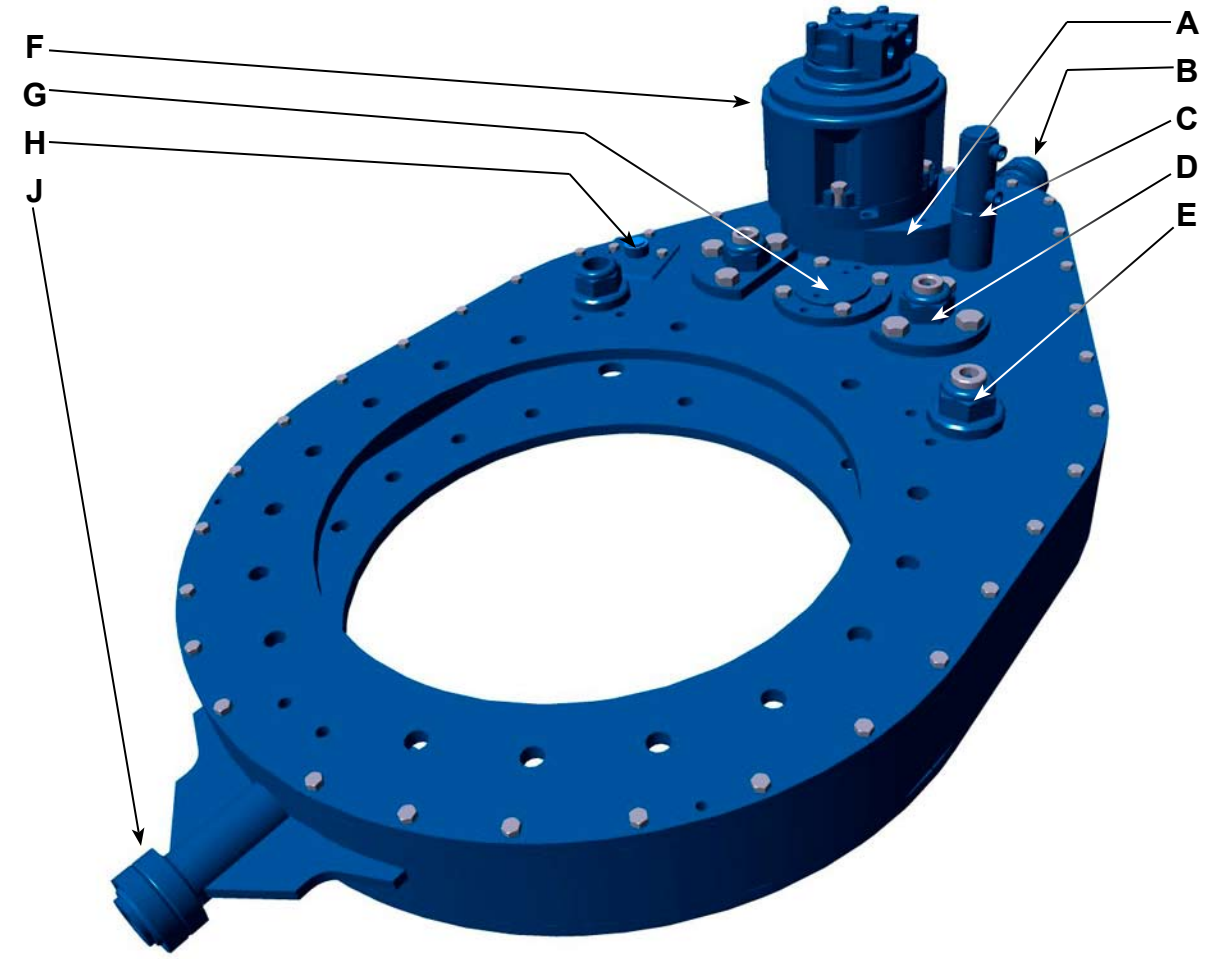
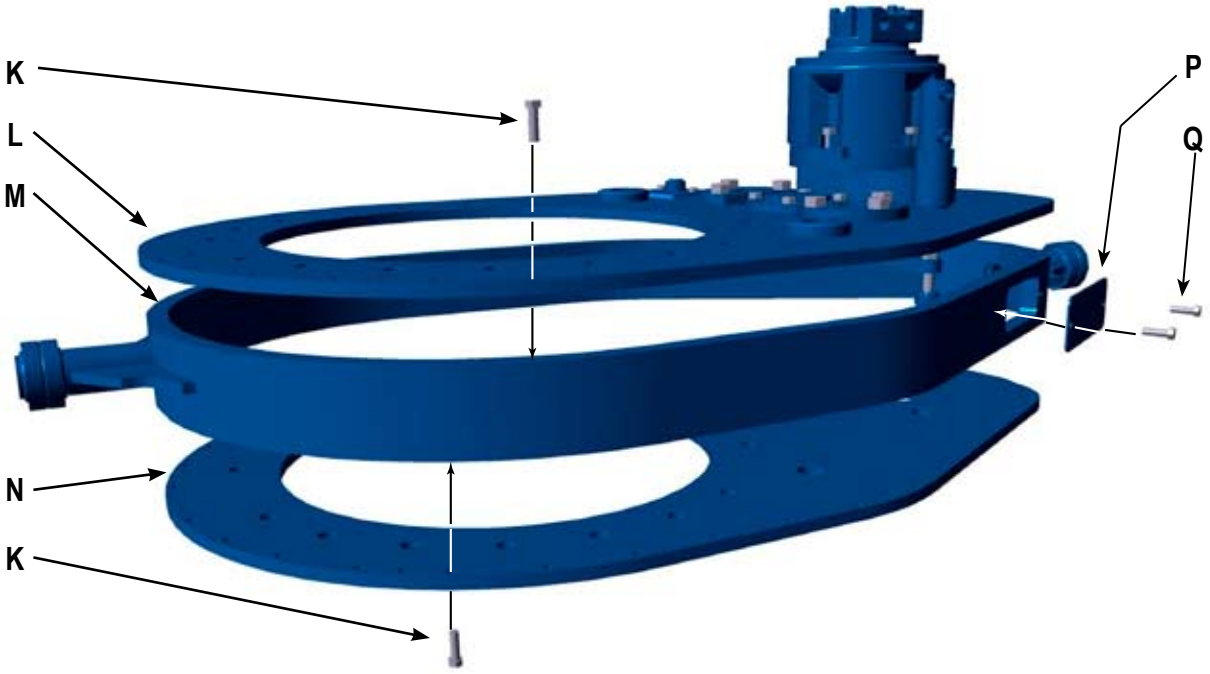
Item	Type	Description	Qty	Part Number
	Assembly	Shifter Assembly	1	AQ01-050
A	Weldment	Shifter Barrel	1	1116-71-01
B	Part	1/2" NC Nylock Nut	1	
C	Part	Shifter Cylinder Piston	1	1037-103-03B
F	Part	Shifting Shaft	1	997-71-01
J	Part	Cylinder Gland	1	1037-103-04
K	Part	Shifting Collar	1	997-HT-62
N	Part	Coupling	1	1393-71R-03
	Part	1/4" x 0.25" Unbrako Cone Point Set Screw (not shown)	2	
P	Part	Cylinder Shaft Guide	1	1393-71R-02
Q	Part	Shifting Fork	1	997-HT-72
R	Part	5/8" Flat Washer	1	
S	Part	5/8 UNF" Jam Nut	1	
T	Part	Bottom Bushing	1	1064-B1-95
SEAL KIT FOR SHIFT CYLINDER (Contains the following items)				**1482-71-SK**
D	Seal	PSP-218 Seal (Piston)	1	
E	Seal	2-112 Rubber O-Ring (Piston)	1	
G	Seal	8-125 Backup Ring (Gland)	1	
H	Seal	2-125 Rubber O-Ring (Gland)	1	
L	Seal	12501000-250E1 Polypak (Gland)	1	
M	Seal	940-9 Shaft Wiper (Gland)	1	

14 1/2" Closed Mouth Trailer-Mounted Bucking Unit

Tong Outer Body





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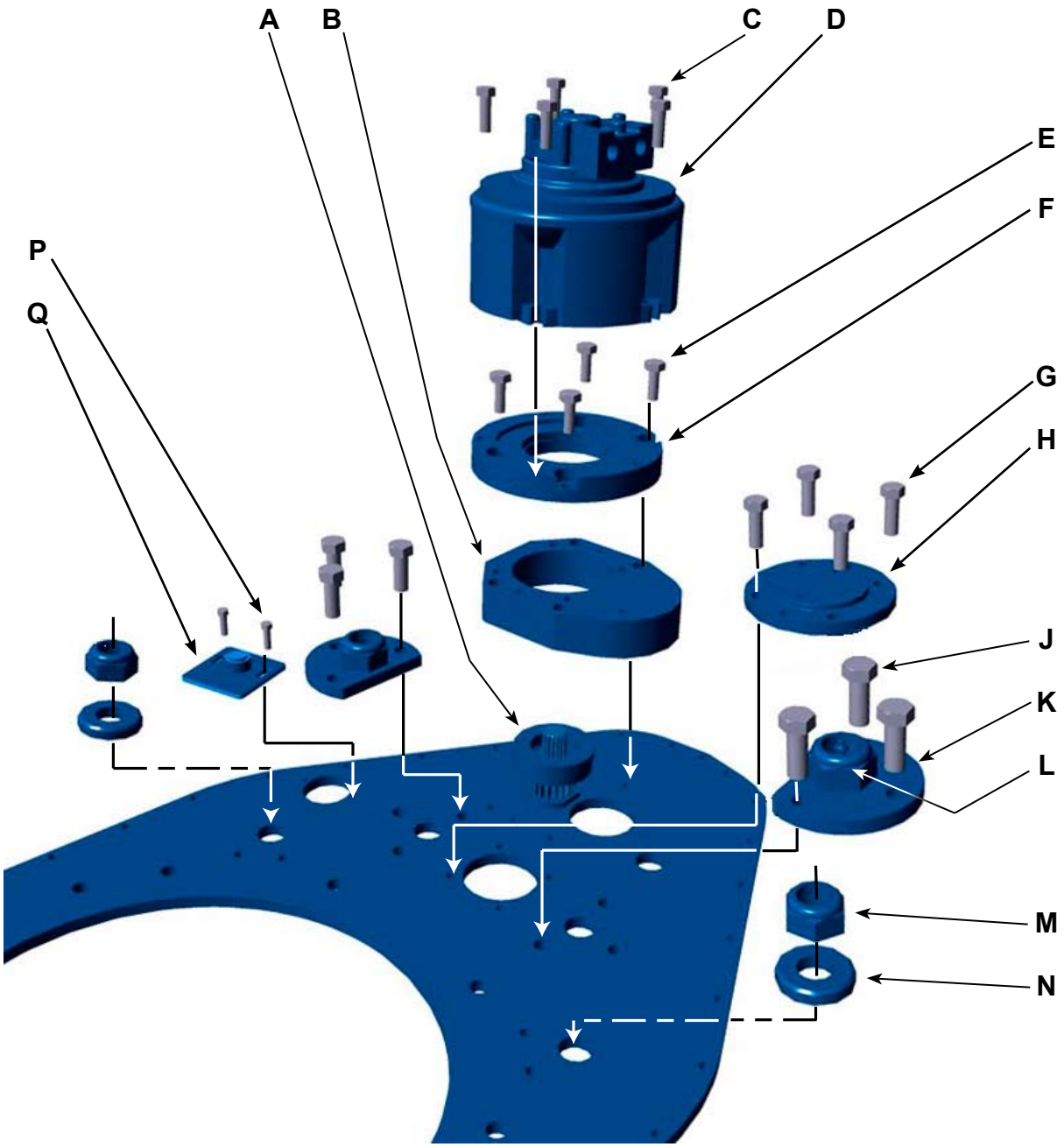
Item	Type	Description	Qty	Part Number
A	Assembly	Motor Mount Assembly	1	AQ15-000
B	Assembly	Motor-Side Tong Pivot Assembly	1	
C	Assembly	Shifter Assembly	1	AQ01-050
D	Assembly	Pinion Idler Assembly	2	AQ01-120
E	Assembly	Rotary Idler Assembly	2	AQ01-100
F	Part	SAI GM1-200 (13 cu. in) Motor	1	87-0149
G	Assembly	Pinion Assembly	1	AQ01-150
H	Assembly	Turn Counter Assembly	1	
J	Assembly	Rotary-Side Tong Pivot Assembly	1	
K	Part	3/8"-NC x 2" hex bolt	68	
L	Part	Top Plate	1	AQ07-102
M	Part	Body Side Panel	1	AQ07-103
N	Part	Bottom Plate	1	AQ07-101
P	Part	Clutch Access Plate	1	AQ07-107
Q	Part	3/8"-NC x 1" hex bolt	2	

NOTE: Parts M and N are typically supplied from the factory as a single welded assembly

Tong Outer Body Detail



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Item	Type	Description	Qty	Part Number
A	Part	Motor Gear	1	997-151-04
B	Part	Motor Mount	1	997-150
C	Part	1/2"-NC x 1-1/2" hex bolt	5	
D	Part	SAI GM1-200 (13 cu. in) Motor	1	87-0149
E	Part	1/2"-NC x 3-1/2" hex bolt	4	
F	Part	Auxilliary Motor Mount	1	997-151-01A
G	Part	1/2"-NC x 1-1/2" hex bolt	8 (4 on bottom)	
H	Part	Bearing Cap - Pinion	2 (1 on bottom)	997-89
J	Part	3/4"-NC x 2" hex bolt	6	
K	Part	Pinion Idler Pad	2	997-D17-109
L	Part	1-1/2" Nylock Nut	2	
M	Part	1-1/2" Nylock Nut	4 (2 on bottom)	
N	Part	Rotary Idler Pad	4 (2 on bottom)	997-D20-125
P	Part	3/8"-NC x 1" hex bolt	2	
Q	Part	Turn Counter Cover	1	1314-03

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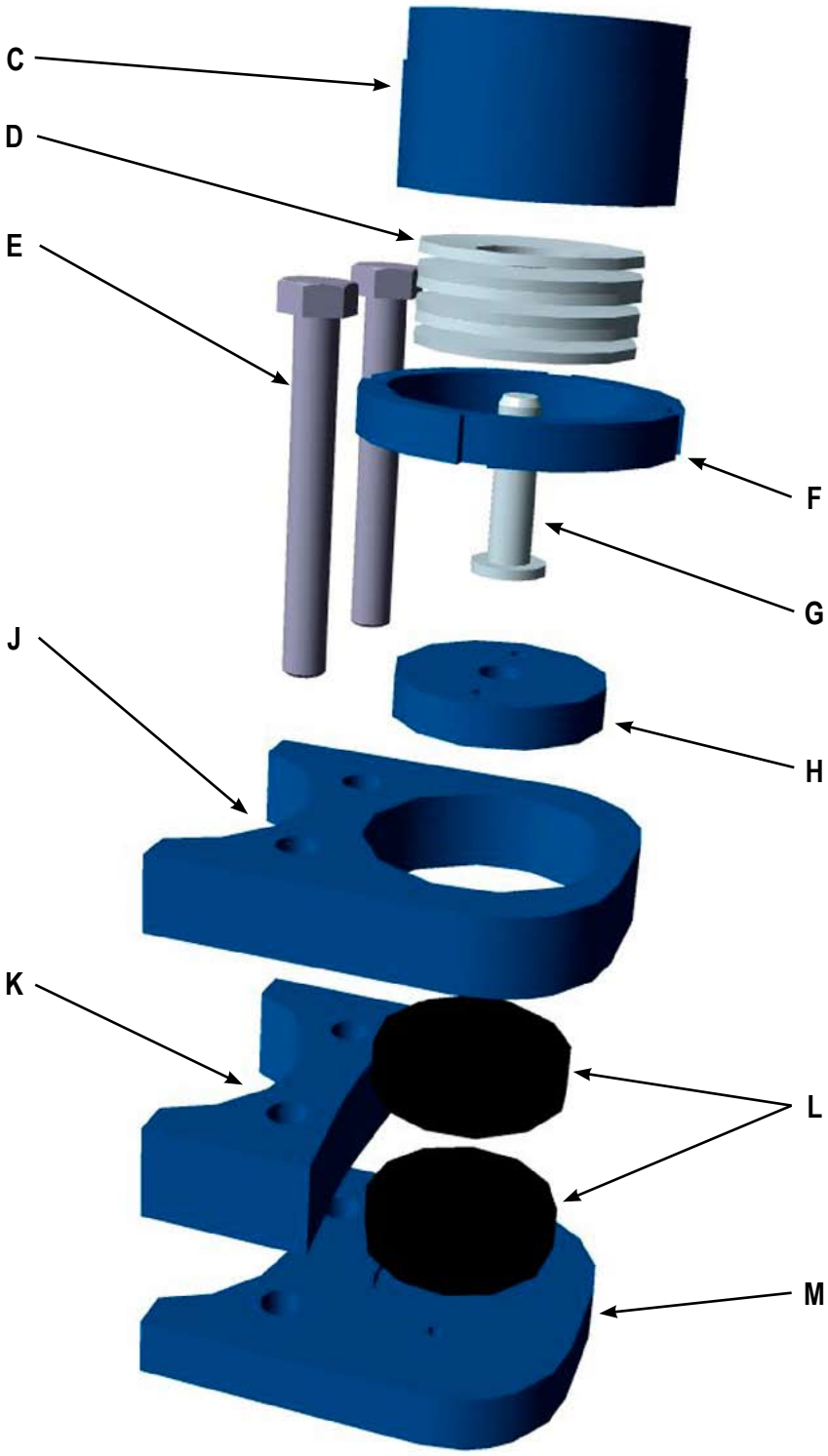

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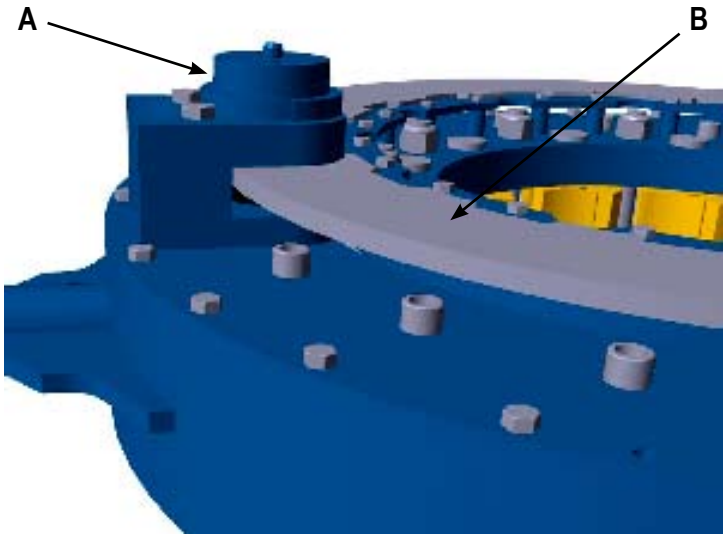
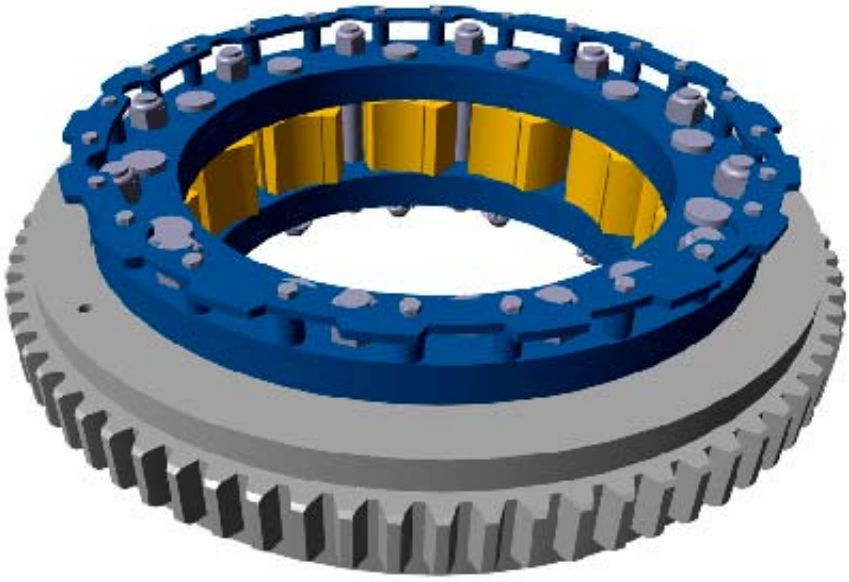
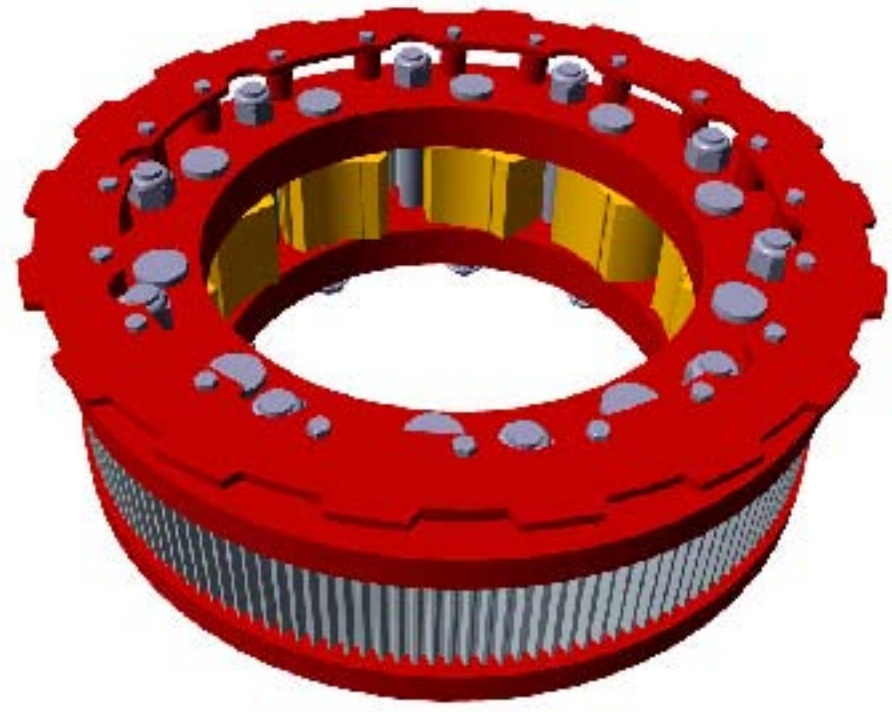


Item	Type	Description	Qty	Part Number
A	Assembly	Caliper Brake Assembly	3	AQ29-100
B	Part	Brake Ring	1	AQ29-001
C	Part	Brake Cup	1	AQ29-102
D	Part	Disc Spring, 2.5" OD, 1.5" ID, 1/8" T	6	
E	Part	1/2"-NC x 4" hex bolt	2	
F	Part	Lock Disc	1	AQ29-108
G	Part	Brake Pin	1	AQ29-106
H	Part	Piston	1	AQ29-103
J	Part	Brake Top	1	AQ29-105
K	Part	Brake Spacer	1	AQ29-104
L	Part	Brake Pads, MICO	2	20-060-037
M	Part	Caliper Spacer	1	AQ29-101



CP1 Cage Plate Assembly
for pipe sizes 12-1/2" to 14-5/8"



CP2 Cage Plate Assembly
for pipe sizes 10-3/8" to 12-1/2"

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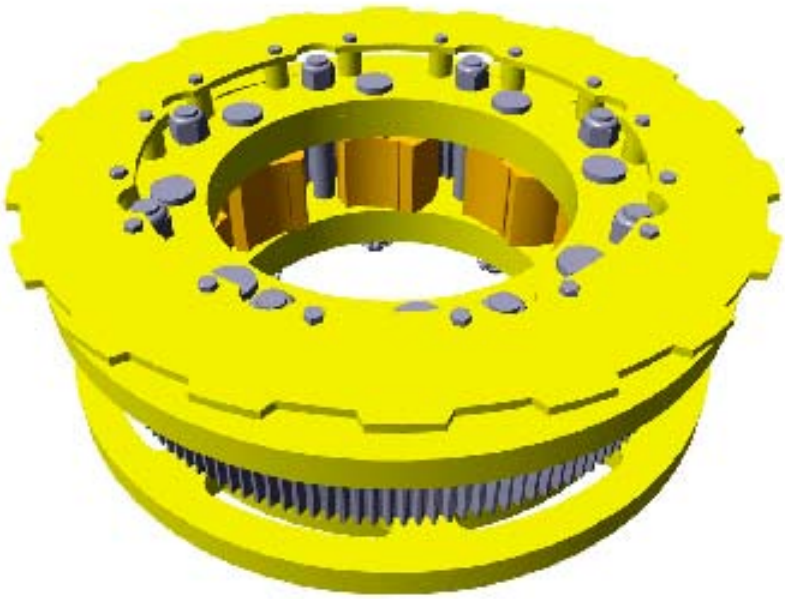
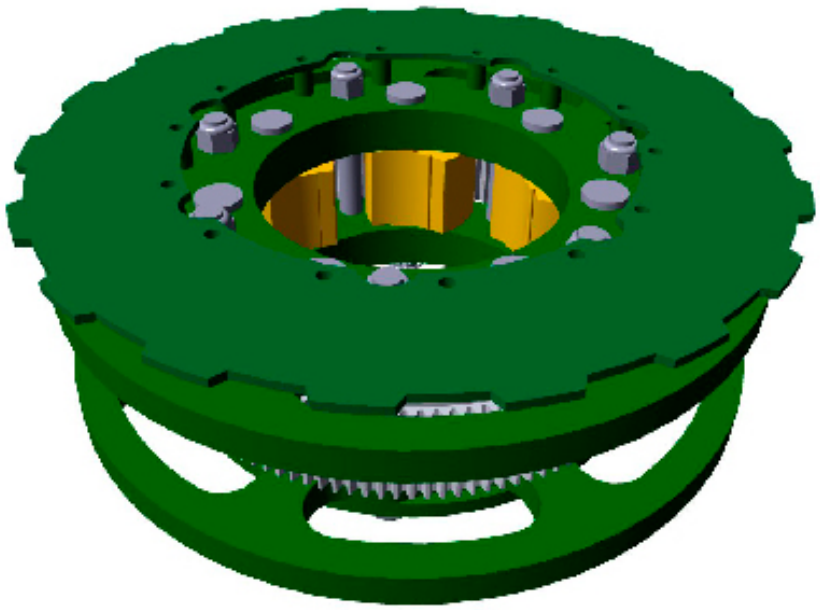


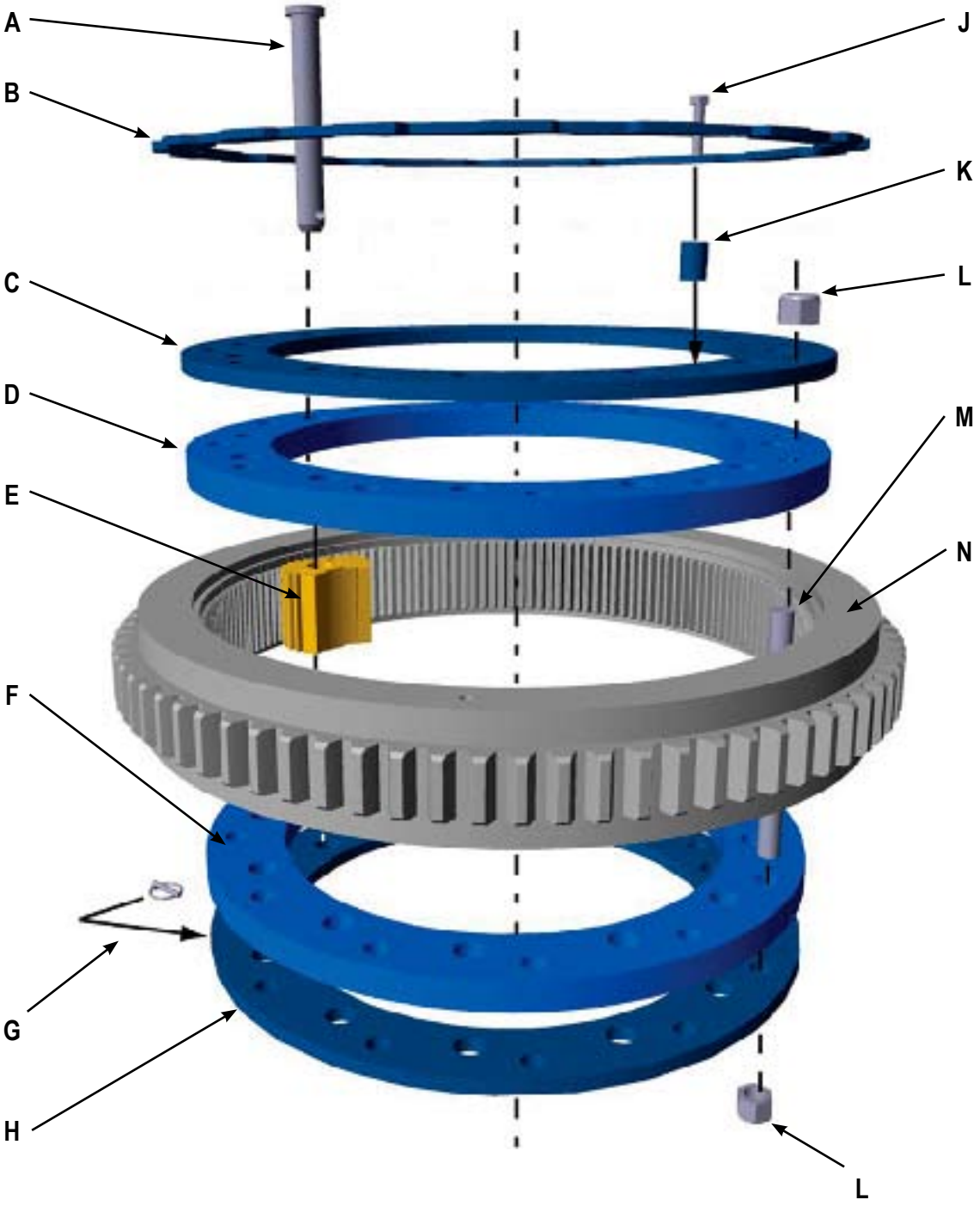
CP3 Cage Plate Assembly
for pipe sizes 8-1/4" to 10-3/8"



CP4 Cage Plate Assembly
for pipe sizes 6-1/4" to 8-3/8"

Item	Type	Description	Qty	Part Number
1	Assembly	Cage Plate Assembly CP1	1	
2	Assembly	Cage Plate Assembly CP2	1	
3	Assembly	Cage Plate Assembly CP3	1	
4	Assembly	Cage Plate Assembly CP4	1	

Cageplate Assembly Exploded



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Item	Type	Description	Qty	Part Number
A	Part	Die Pin CP1 (shown)	12	AQ20-001
		CP2 (not shown)	10	(same)
		CP3 (not shown)	8	(same)
		CP4 (not shown)	7	(same)
B	Part	Connector Ring CP1 (not shown)	1	AQ20-103
		Connector Ring CP2 (not shown)	1	AQ20-203
		Connector Ring CP3 (not shown)	1	AQ20-303
		Connector Ring CP4 (not shown)	1	AQ20-403
C	Part	Cage Plate Reinforcement CP1 (shown)	1	AQ20-102
		Cage Plate Reinforcement CP2 (not shown)	1	AQ20-202
		Cage Plate Reinforcement CP3 (not shown)	1	AQ20-302
		Cage Plate Reinforcement CP4 (not shown)	1	AQ20-402
D	Part	Cage Plate CP1 (shown)	1	AQ20-101
		Cage Plate CP2 (not shown)	1	AQ20-201
		Cage Plate CP3 (not shown)	1	AQ20-301
		Cage Plate CP4 (not shown)	1	AQ20-401
E	Assembly	CP1 Jaw Assembly	12	
	Part	Die Holder		
	Part	Die		
	Assembly	CP2 Jaw Assembly	10	
	Assembly	CP3 Jaw Assembly	8	
	Assembly	CP4 Jaw Assembly	7	
F	Part	Cage Plate CP1 (shown)	1	AQ20-101
		Cage Plate CP2 (shown)	1	AQ20-201
		Cage Plate CP3 (shown)	1	AQ20-301
		Cage Plate CP4 (shown)	1	AQ20-401
G	Part	Linch Pin	12	
		CP2 (not shown)	10	
		CP3 (not shown)	8	
		CP4 (not shown)	7	
H	Part	Cage Plate Back Up CP1 (shown)	1	AQ20-105
		Cage Plate Back Up CP2 (not shown)	1	AQ20-205
		Cage Plate Back Up CP3 (not shown)	1	AQ20-305
		Cage Plate Back Up CP4 (not shown)	1	AQ20-405

cont'd next page

Item	Type	Description	Qty	Part Number
J	Part	3/8"-NC x 2" hex bolt	24	
		CP2 (not shown)	20	
		CP3 (not shown)	16	
		CP4 (not shown)	14	
K	Part	Brake Spacer	24	AQ20-003
		CP2 (not shown)	20	(same)
		CP3 (not shown)	16	(same)
		CP4 (not shown)	14	(same)
L	Part	3/4"-NC Nylock Nut	24	
		CP2 (not shown)	20	
		CP3 (not shown)	16	
		CP4 (not shown)	14	
M	Part	Spacer Pin	12	AQ20-002
		CP2 (not shown)	10	(same)
		CP3 (not shown)	8	(same)
		CP4 (not shown)	7	(same)
N	Part	Master Ring Gear	1	AQ01-001
	Part	CP2 Spacer (See Page 6.14)	1	AQ01-010
	Part	CP3 Spacer (See Page 6.14)	1	AQ01-020
	Part	CP4 Spacer (See Page 6.14)	1	AQ01-030

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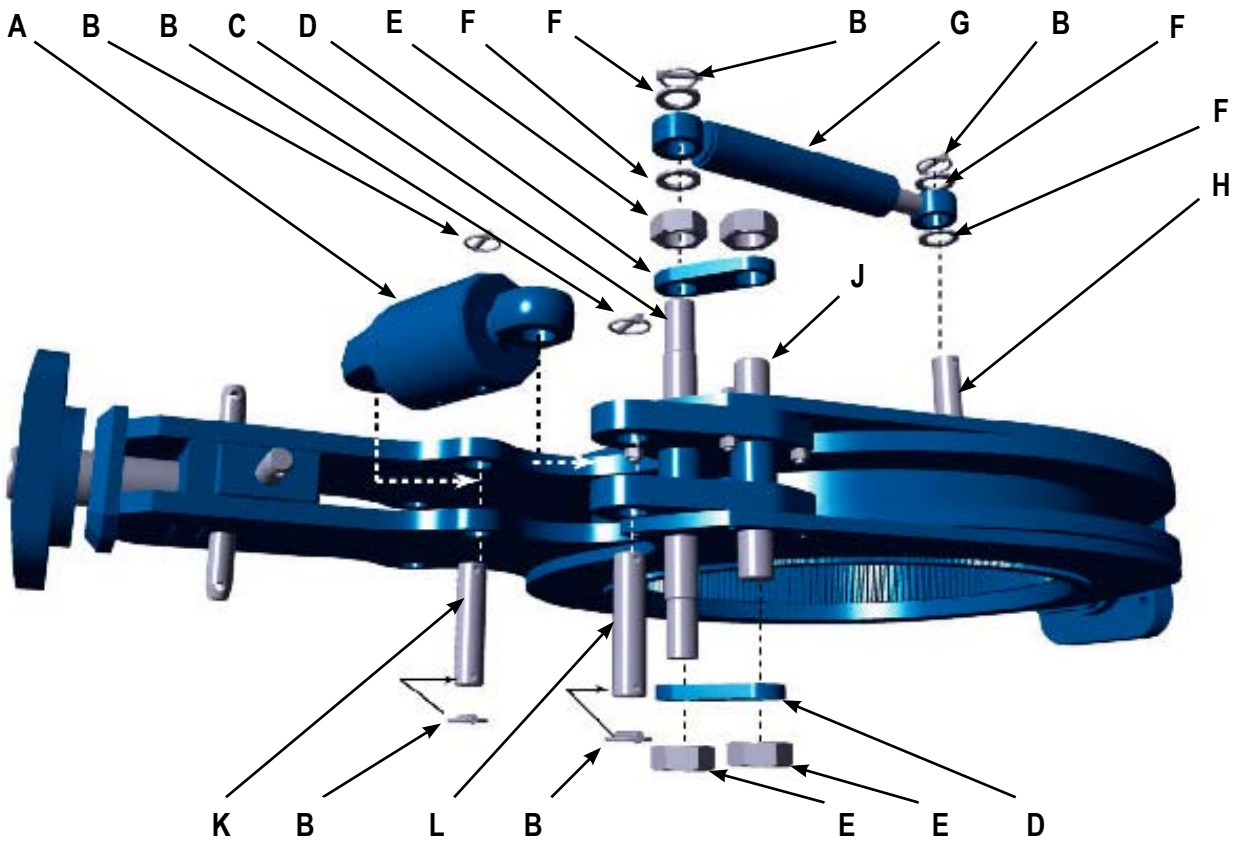

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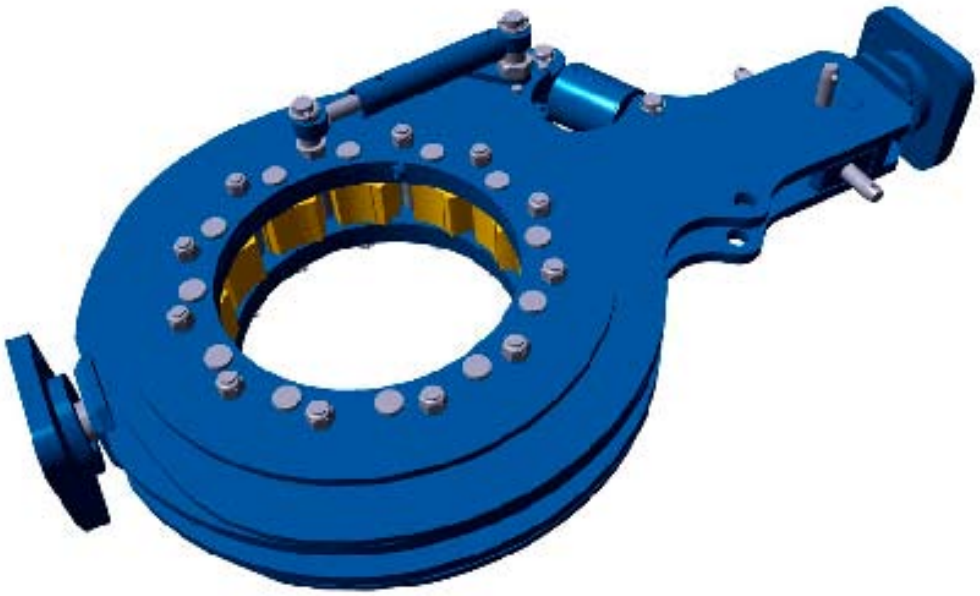
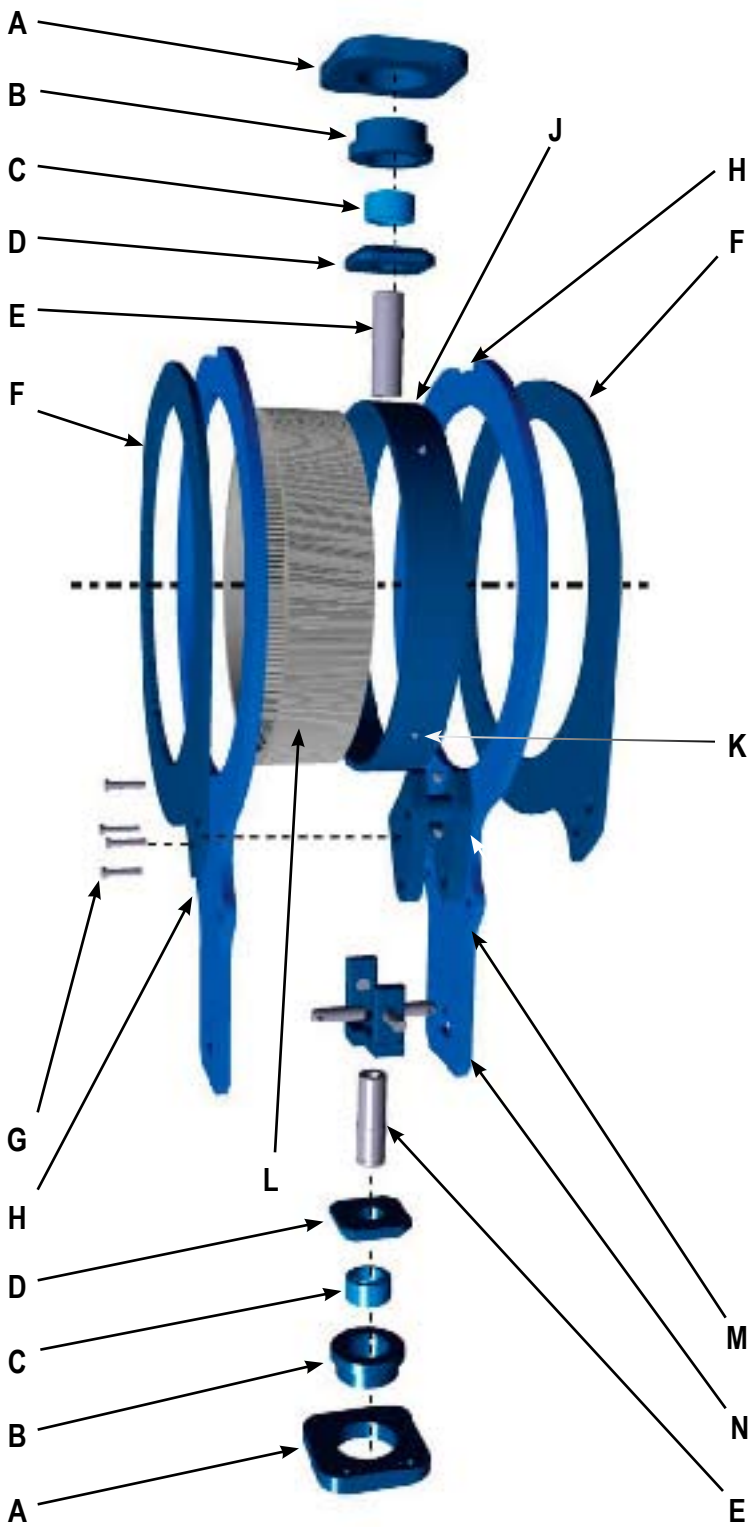


Item	Type	Description	Qty	Part Number
	Assembly	Back Up	1	AQ10-000
A	Assembly	Load Cell	1	LC99-100
B	Part	Linch Pin, McMaster Carr 90170A212	6	
C	Part	Back Up Lug Pin, Tall	1	AQ10-007
D	Part	Back Up Pin Spacer	2	AQ10-011
E	Part	1-1/2"-UNF Nylock Jam Nut	4	
F	Part	Back Up Cylinder Washer	4	AQ10-009
G	Assembly	Hydraulic Cylinder	1	1037-103-22
H	Part	Back-up Cage Plate Peg	1	AQ10-006
J	Part	Back Up Lug Pin, Short	1	AQ10-008
K	Part	Load Cell Pin, Frame	1	AQ10-002
L	Part	Load Cell Pin, Cage Plate	1	AQ10-001



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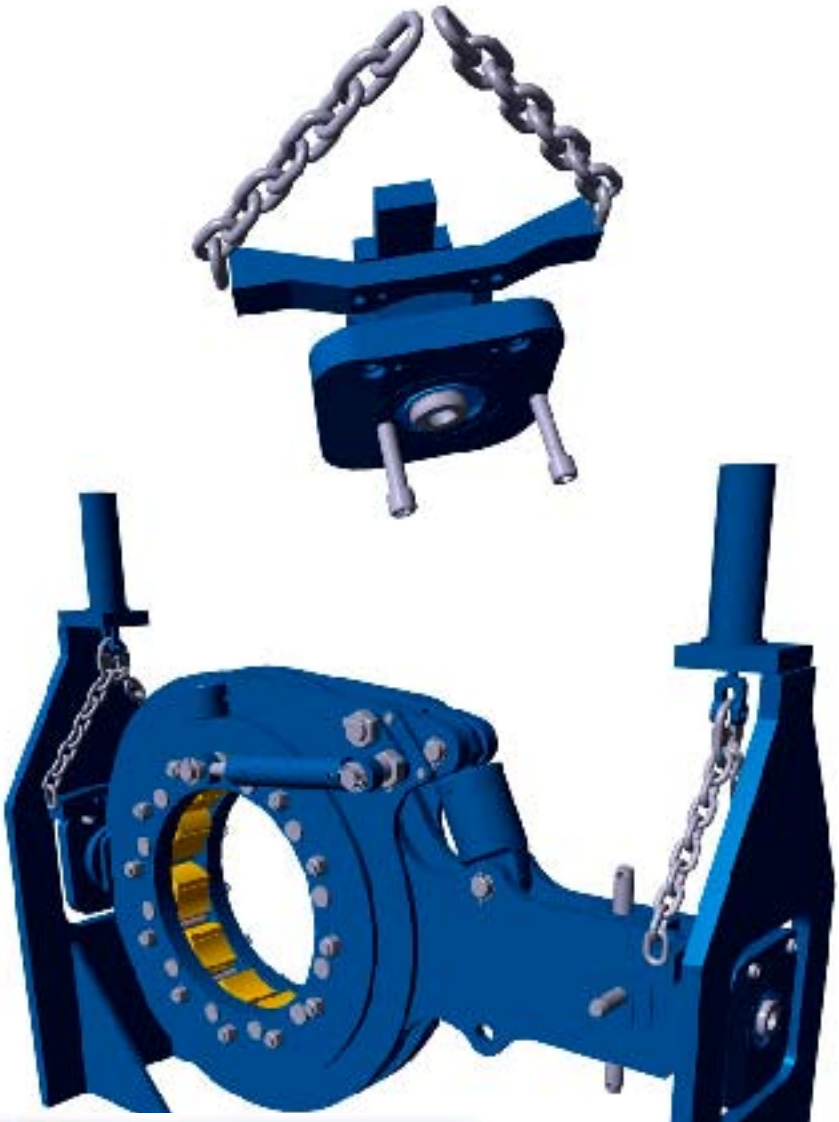
Item	Type	Description	Qty	Part Number
A	Part	Back Up Float Plate	2	AQ10-013
B	Part	Back Up Float Plate Boss	2	AQ10-012
C	Part	Back Up Support Bushing, Brass	2	AQ10-019
D	Part	Back Up Pivot Support	2	AQ10-103
E	Part	Back Up Pivot Axis	2	AQ10-105
F	Part	Back Up Rotary Plate	2	AQ10-003
G	Part	3/8"-NC x 2" hex bolt and 3/8"-NC nut	4	
H	Part	Back-up Frame	2	AQ10-101
J	Part	Back Up Housing	1	AQ10-102
K	Part	Grease Fitting, 1/8" NPT	4	02-0005
L	Part	Rotary Gear	1	AQ10-004
M	Assembly	Rotary Plate Lug Assembly	1	AQ10-001
	Part	Rotary Plate Lug	2	AQ10-006
	Part	Spacer Tube	2	AQ10-010
N	Assembly	Pivot Support & Rotation Locks	1	
	Part	Pivot Support	1	AQ10-104
	Part	Lock Pin Block	2	AQ10-106
	Part	Lock Pin	4	AQ10-107

Note: Parts D (x 2), E (x 2), H (x 2), J, and N are typically supplied from the factory as a single welded assembly.

Backup And Frame (with Rotation Stop)



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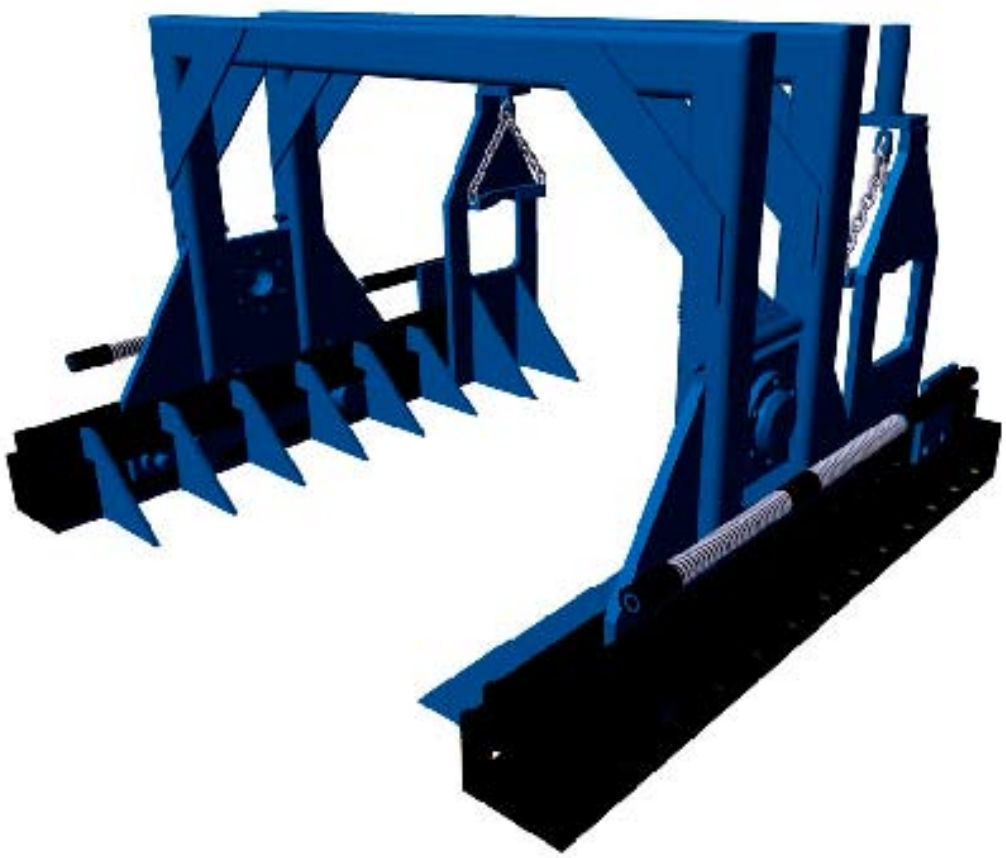
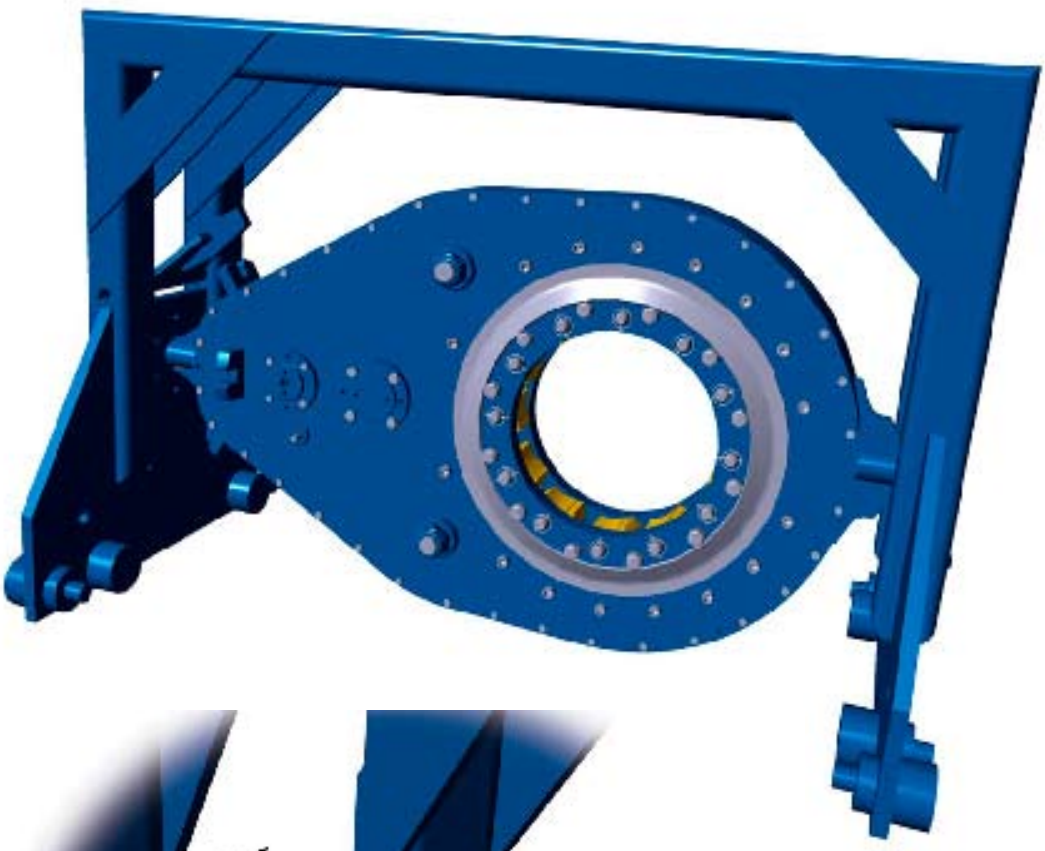


Tong And Frame (with Rotation Stop)



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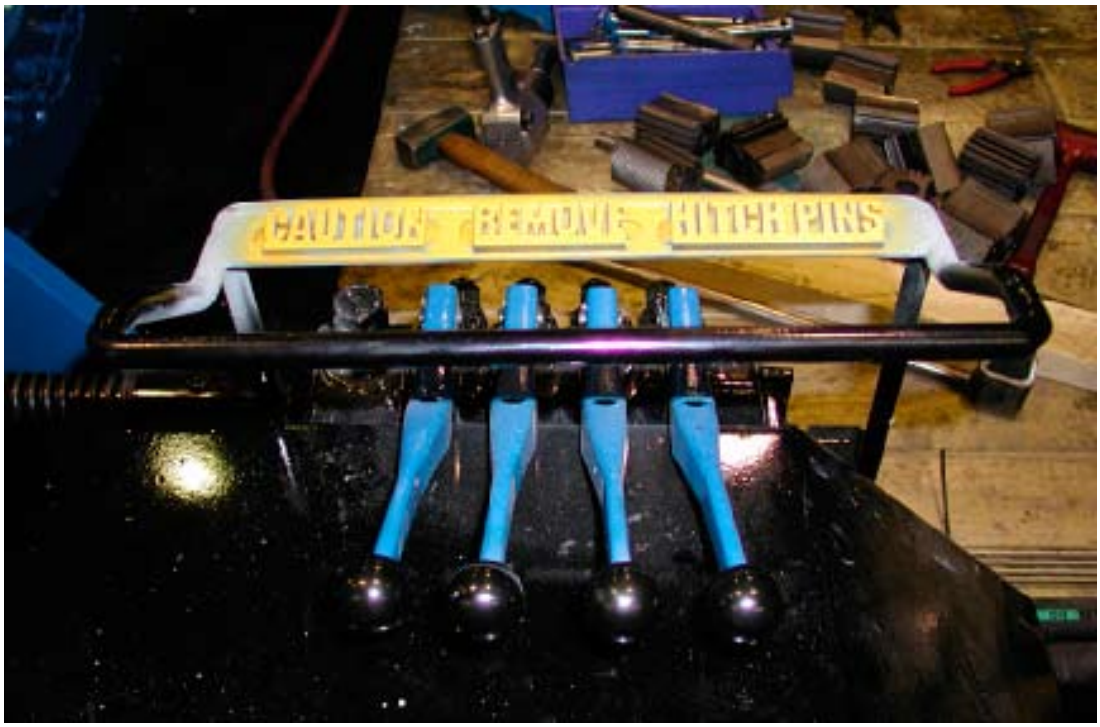

1. *Ensure hitch pins have been removed from trailer jacks before actuating control levers.*

2. *Adjust trailer jacks in small increments until the assembly has been aligned to the proper requirements.*

! ***ONCE THE TRAILER JACKS HAVE BEEN ADJUSTED, THE ADJUSTMENT LEVERS MUST BE LOCKED TO PREVENT ACCIDENTAL ADJUSTMENT OF JACKS.***

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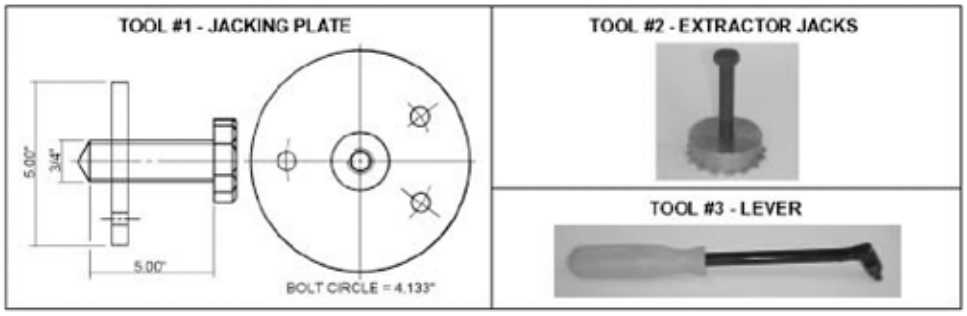
A. OVERHAUL SAI Motor

The instructions contained in this section cover a complete disassembly and assembly of the piston type fluid motor.

Drain all fluid from the motor and thoroughly clean the exterior surface. Prepare a clean, lint-free surface on which to lay the internal parts of the motor.

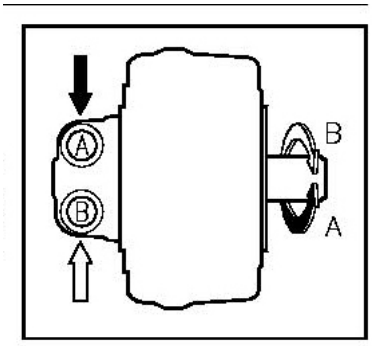
1. STANDARD TOOLS
    1. 7/32" Allen wrench
    2. Arbor Press
    3. Awl
    4. 1-1/2" dia. steel ball
    5. Bearing puller (Owatonna Tool Co.,MD-959 or equivalent)
    6. Clean lintless cloths
    7. Deburring tool (an old file with the cutting teeth ground off)
    8. Machinist's hammer
    9. Soft hammer
    10. Loctite stud lock (red)
    11. Loctite oil seal retainer (purple)
    12. Medium grit carborundum stone
    13. Oil and grease
    14. Snap ring pliers
    15. Prick punch
    16. Sharp razor blade
    17. Scale (1/32" or 1/64" graduations)
    18. Small screwdriver
    19. Torque wrench
    20. Vise with 6" minimum open spread

B. SPECIAL TOOLS



DIRECTION OF SHAFT ROTATION

All motors are bidirectional. The direction of shaft rotation is determined by the direction of oil flow. Standard motors are supplied so that flow entering in port A causes the shaft to rotate clockwise (as seen from the shaft side of the motor). Flow entering port B causes anticlockwise rotation. To invert the direction of rotation of the shaft, invert the direction of the flow, or invert port A and port B tube connections, or invert the phase of the distributor (see motor order codes, see the maintenance manual or contact SAI).



2. DISASSEMBLY

NOTE: ON ASSEMBLY AT THE FACTORY ONE OF THE DISTRIBUTOR CLOSING BOLTS IS LEAD SEALED. THE NUMBER ON THE SEAL IS A FACTORY REFERENCE NUMBER AND SHOULD NOT BE REMOVED. THE GUARANTEE, WHERE APPLICABLE, ON MOTORS RETURNED FOR REPAIRS IS ONLY VALID IF THIS SEAL IS INTACT.

A. PRELIMINARY STEPS

Drain the motor casing of oil. In order to be able to re-assemble the distributor in the same position it is advisable to mark the alignment of the distributor ports with respect to the drain-line holes. To help with fault diagnosis it is advisable to mark also the position of the motor cover with respect to the motor body and, after step 3, the position of each of the cylinders with respect to the motor body.

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B. REMOVING THE DISTRIBUTOR

Remove the 5 closing bolts of the distributor. Lift off the distributor cover and the distributor rotary [1]. Take out the distributor drive pin and the distributor centering bush. If the distributor is of the type with the bronze bearing disc, remove also the two locating pins.

IMPORTANT: THE WORKING SURFACES OF DISTRIBUTOR ROTARY, DISTRIBUTOR DISC & MOTOR COVER MUST NOT BE SCRATCHED OR DAMAGED IN ANY WAY.

C. REMOVING THE MOTOR COVER

Remove motor cover closing bolts. With an appropriate jacking plate, using the distributor bolt holes and levering on the shaft through the distributor drive pin hole, lift off the motor cover. Remove the motor cover/ body seals and locating pins.

See Section 8.1.B, Page 8.2, Special Tool #1

D. REMOVING THE REAR RETAINING RINGS

Using appropriate snap ring pliers, remove the retaining clip. Take off the spring and the retaining ring.

E. REMOVING THE CYLINDERS

Rotate the shaft so that the piston of the cylinder to be removed is fully extended. By hooking a finger under the piston lift up the piston, tapping the cylinder trunnion with a rubber hammer to loosen the piston from the shaft. Lift out the cylinder and piston. The piston may be extracted for inspection of seals and working surfaces.

See Section 8.1.B, Page 8.2, Special Tool #2

F. REMOVING THE SHAFT

It is advisable to place a protective covering over the spline of the shaft (e.g., tape) before extraction to avoid damaging the shaft seal. Motors with roller bearings: lift out the shaft. Motors with ball bearings: remove the shaft by tapping on the end of the shaft with a rubber hammer.

G. REMOVING THE SHAFT BEARINGS

If it is necessary to replace the shaft bearings, the bearing races can be removed from the shaft or from the motor cover or body using appropriate extractor jacks.

IMPORTANT: IF THE BEARINGS DO NOT NEED TO BE REPLACED IT IS RECOMMENDED THAT THE BEARING RACES ARE NOT REMOVED FROM THE MOTOR COVER OR BODY.

3. REASSEMBLY

With GM-series motors the shaft and cylinder sub-assemblies are mounted on the motor cover and not in the motor body as with M-series motors. Before proceeding with the reassembly of the motor:

- *Ensure that the lubrication channels in the cylinder trunnion seats of both motor body and cover are clean.*
- *Check that the distribution plane on top of the motor cover is perfectly flat and smooth.*

A. SHAFT SEAL

Ensure that the shaft seal in the motor body has not been damaged. Replace if necessary.

B. BEARING ASSEMBLY

To avoid the possibility of damage to the bearing seat in the motor cover or the motor body caused by edges on the external diameter of the bearing race the motor body or cover should be heated to a temperature of 80°C before inserting the bearing. Alternatively smooth down any edges, even slight ones and especially in the area of the corner fillets, that may have remained after the machining processes. Roller bearings: to avoid the possibility of axial shocks the outer bearing race should be placed in the motor cover or body and the inner race should be assembled to the shaft. Ball bearings: these should be inserted in the motor body or cover (and not assembled to the shaft).

C. SHAFT ASSEMBLY

Replace the piston retaining ring, spring and C-clip to the rear-side of the piston support ring. Dislodge the C-clip from the front-side of the piston support ring. Insert the shaft in the bearing seat in the motor cover, in the case of ballbearings using a rubber hammer to tap it home. (Keep shaft shoulder 0.250 away from bearing race.)

D. CYLINDER ASSEMBLY

Insert O-ring and plastic slipper seal in the cylinders. Insert O-ring, plastic ring seal, steel ring and shaped insert into the cylinder trunnions. Insert the pistons in the cylinders. Place the longer cylinder trunnion containing the seal into the trunnion seat in the motor cover. Slide the piston out onto the piston support ring and place the lip of the piston foot between the piston retaining ring and the piston support ring. Using an appropriate lever ensure that the piston foot comes into full contact with the piston support ring. It may be necessary to lift the cylinder and shaft out of their seats a little to facilitate the operation. Repeat for all five cylinders. Position the front retaining ring and spring over the piston feet and insert C-clip. By tapping lightly with a rubber hammer on the cylinder trunnions and shaft-end ensure that cylinders and shaft are prop erly seated.

E. MOTOR BODY AND COVER ASSEMBLY

Grease all the motor cover and body O-ring seats, position O-rings, and insert the locating pins. Position the motor body aligning the trunnion seats with the cylinder trunnions and gently lower the motor body into place, taking care not to damage the shaft seal. For motors with the O-rings between the cover and body, it is advisable to insert the bolts in the cover to ensure that the O-rings are correctly positioned when closing the motor. Turn the motor over so that the shaft points downwards, insert and tighten the motor cover closing bolts.

IMPORTANT: DO NOT HAMMER THE DISTRIBUTION SURFACE IN THE CENTER OF THE MOTOR COVER. USING AN APPROPRIATE LEVER INSERTED IN THE DISTRIBUTOR DRIVE-PIN SLOT ENSURE THE SHAFT ROTATES THROUGH 360° WITHOUT EXCESSIVE OR VARIABLE RESISTANCE.

See Section 8.1.B, Page 8.2, Special Tool #3

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F. SETTING THE DIRECTION OF MOTOR SHAFT ROTATION

For the motor shaft to rotate as described in the section "Direction of Shaft Rotation" on page 4, the motor has to be put "in phase" before the distributor is assembled.

To set the motor "in phase": Choose any one of the cylinders of the motor (termed the "reference cylinder"). Rotate the motor so that in relation to the center of the motor and the viewpoint of the operator, the reference cylinder is on the opposite side of the motor and in line with the operator. With an appropriate lever inserted in the distributor drive pin slot in the end of the shaft, rotate the shaft until the reference mark to one side of the slot is positioned on the same side as the reference cylinder. Keeping note of the reference cylinder proceed with the assembly of the distributor. To set the motor "out of phase": Position the reference cylinder as described above. Rotating the shaft so that the reference mark is on the opposite side and in line with the reference cylinder (rotated 180° from the in phase position) the motor will be out of phase and the shaft will rotate in the opposite direction from that indicated above.

If there are no reference marks on the shaft: Position the reference cylinder as described before. Rotate the shaft so that the distributor drive pin slot is perpendicular to the line between the center of the motor and the reference cylinder. Closing one of the cylinder feed channels to the left of the reference cylinder, rotate the shaft a quarter turn anti-clockwise. The motor is in phase if suction of the cylinder is felt with a finger. The motor is out of phase if the cylinder compression is felt with a finger. Return the lever to the starting position. If the motor was out of phase, rotate the shaft 180° to put it in phase, or vice-versa.

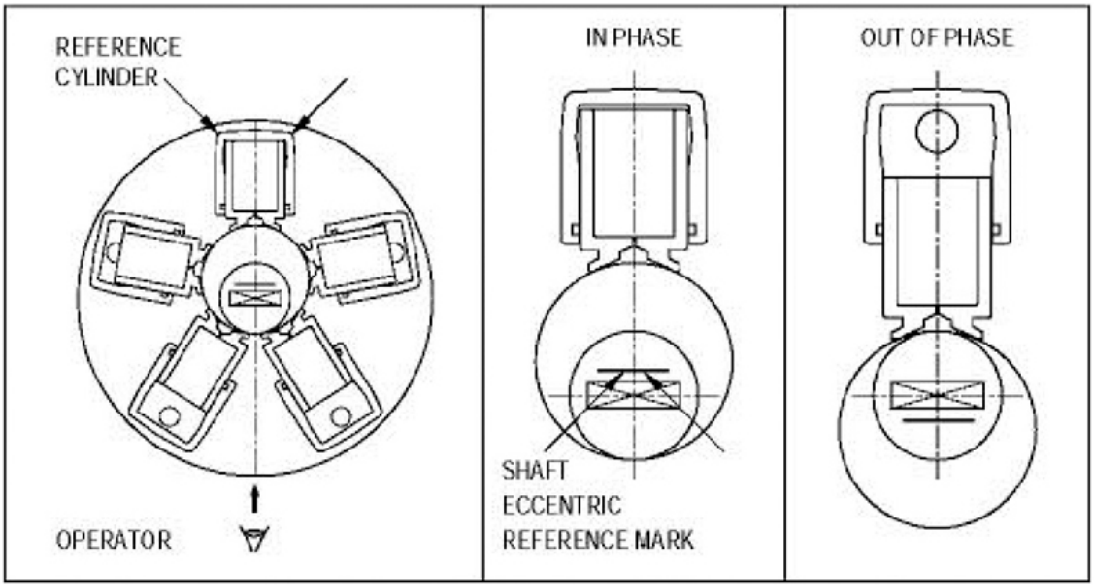
H. DISTRIBUTOR ASSEMBLY

IMPORTANT: TO AVOID SERIOUSLY DAMAGING THE MOTOR, DO NOT ATTEMPT TO PLACE A DISTRIBUTOR COVER PRE-ASSEMBLED WITH ROTARY VALVE AND DISC DIRECTLY ONTO THE MOTOR COVER. THE INTERNAL COMPONENTS OF THE DISTRIBUTOR MUST BE ASSEMBLED SEPARATELY FROM THE DISTRIBUTOR COVER.

IMPORTANT: ENSURE THAT NO OBJECTS (E.G., LOCATING PINS) FALL INTO CYLINDER FEED HOLES IN THE MOTOR COVER. IF THIS HAPPENS IT WILL BE NECESSARY TO DISMANTLE THE MOTOR TO REMOVE THE OBJECT.

See Tool #3.

ROTARY VALVE SUB-ASSEMBLY: Insert the O-ring and plastic slipper with the concave side on the O-ring side in the seat in the top side of the distributor rotary. The plastic seal should be assembled by first placing the positioning lug in its seat. For versions with the steel ring; first place the O-ring, then the plastic seal (without lug) and then the steel ring.



DISTRIBUTOR COVER SUB-ASSEMBLY: Insert the distributor/motor cover O-ring in the seat in the bottom of the distributor cover. For distributors with the bronze disc; insert the O-ring and the plastic slipper with the chamfer on the side of the bottom of the distributor.

ROTARY GROUP ASSEMBLY: Insert distributor drive pin in shaft through the central hole in motor cover.

NOTE: ENSURE THAT NO OBJECTS FALL INTO COVER. IF THIS HAPPENS IT WILL BE NECESSARY TO DISMANTLE THE MOTOR TO REMOVE THE OBJECTS. INSERT THE LOCATING PINS IN THEIR HOLES IN THE MOTOR COVER.

Place the disc on cover, positioning it with the locating pins. Motors without the disc do not have locating pins.

NOTE: MOTORS PRODUCED BEFORE 7/87 USED .236 INCH PINS. MOTORS PRODUCED AFTER 7/87 USE .196 INCH PINS. A CERTAIN NUMBER OF DISCS PRODUCED HAVE HOLES FOR BOTH TYPES OF PIN AND IT IS IMPORTANT WHEN PLACING THE DISC THAT IT IS POSITIONED USING THE CORRECT HOLES. THE DISC MUST SIT FLUSH WITH THE MOTOR COVER. IT DOES NOT NEED TO BE PRESSED ON AND THE FIVE OIL FEED HOLES MUST LINE UP WITH THE HOLES IN THE MOTOR COVER. ONCE POSITIONED IT MUST NOT BE ABLE TO ROTATE OR TO MOVE LATERALLY. INSERT THE CENTERING BUSH IN THE DISC POSITION THE DISTRIBUTOR ROTARY ON THE DISC WITH THE SIDE CONTAINING THE SEALS ON TOP AND WITH THE THREE RADIAL HOLES TO THE LEFT OF THE REFERENCE CYLINDER AND THE THREE AXIAL HOLES TO THE RIGHT.

DISTRIBUTOR COVER ASSEMBLY: Place the distributor cover over the rotary, aligning the bolt holes in the distributor cover and the motor cover. The distributor can be placed in any one of the five positions. Screw in and tighten the five bolts.

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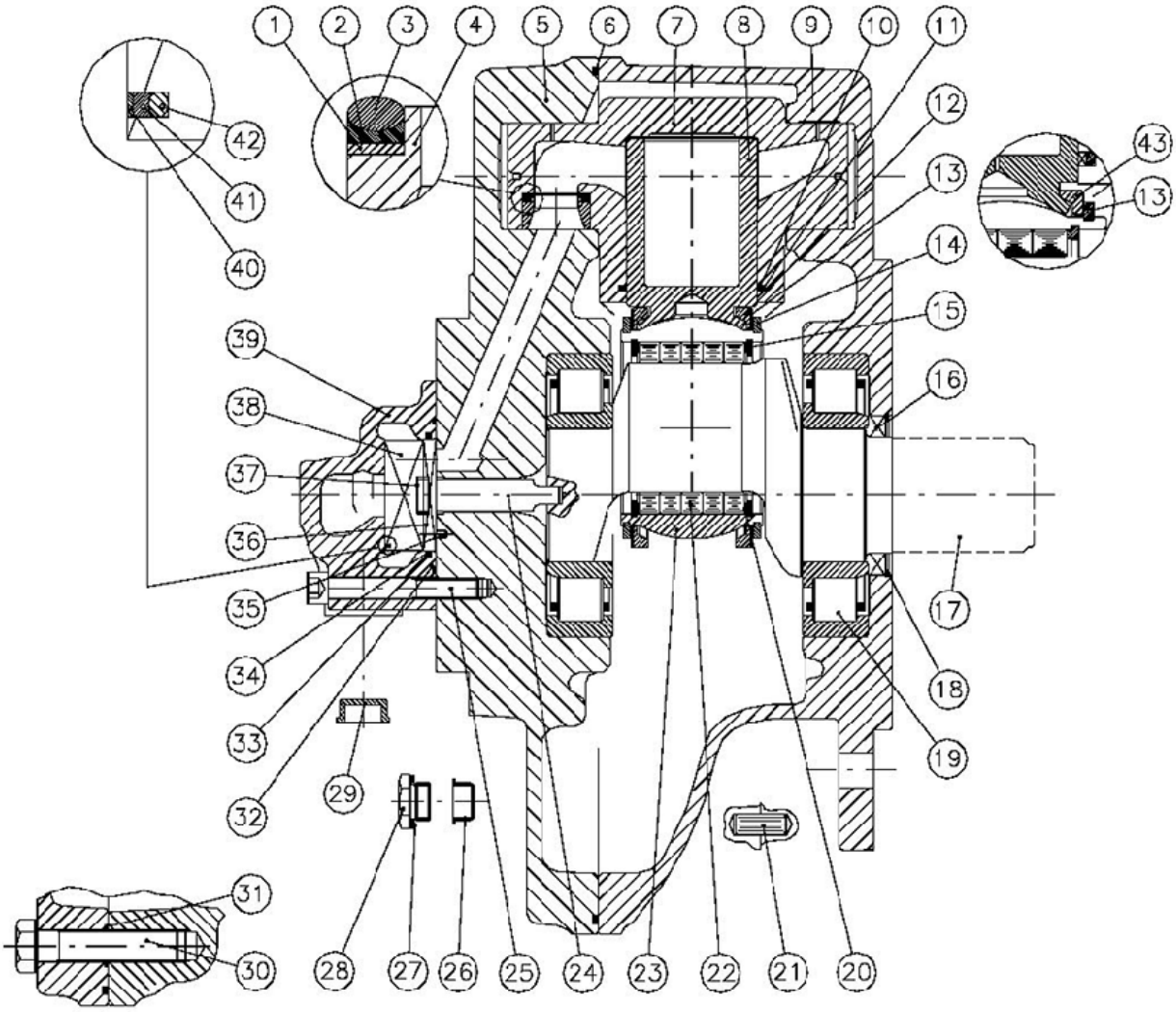

TABLE 1 - GM1 SPARE PARTS

#	DESCRIPTION	QTY	PART #
1	STEEL RING	5	0010301136
**2	PLASTIC ANTI-EXTR RING	5	0010001121
**3	O-RING	5	0010012065
4	STEEL SEAL	5	0148002108
5	COVER	1	0148105002
**6	O-RING SEAL	1	0010012336
7	CYLINDER	5	SEE TAB. 2
8	PISTON	5	SEE TAB. 2
9	BODY	1	0148109001
*10	CYLINDER SEAL	5	SEE TAB. 2
*11	CYLINDER O-RING	5	SEE TAB. 2
12	PISTON RET. RING	2	0106102211
13	PISTON RET. SPRING	2	0106100220
14	INT. RETAINING C-CLIP	2	0010001109
15	EXT. RETAINING C-CLIP	2	0010001013
**16	SHAFT SEAL	1	0010002066
17	SHAFT	1	SEE TAB. 3
18	RETAINING C-CLIP	1	0010001066
19	SHAFT BEARINGS	2	SEE TAB. 4
20	SPACER RING	2	0010318065
21	LOCATING PIN 12x28	2	0010020048
22	ROLLER	84	0010020026
23	SPHER. SUPPORT RING	1	0106120210
23A	SUPPORT W/O SPRING	1	0100130210
24	DRIVE PIN	1	0106103109
25	SKTHD BOLT (M12x65)	5	SEE DIST.
26	PLASTIC PLUG 1/2"	1	0010023064
27	ALUM. WASHER 1/2"	1	0010018094
28	ZINC DRAIN PLUG 1/2"	1	0010023051
29	PLASTIC PLUG	2	0010023063
30	HXHD BOLT 8.8 (M14x35)	5	0010025213
**31	O-RING SEAL 1.78 #2.016	5	0010022237
32	O-RING	1	SEE DIST.
33	O-RING	1	SEE DIST.
34	SLIPPER PLAS. SEAL	1	SEE DIST.
35	DOWEL PIN 6x8	2	SEE DIST.
36	DISC BRONZE WP	1	SEE DIST.
37	BUSHING	1	SEE DIST.
38	ROTARY DISTRIBUTOR	1	SEE DIST.
39	DISTRIBUTOR COVER	1	SEE DIST.
40	STEEL RING	1	SEE DIST.
41	SLIPPER SEAL	1	SEE DIST.
**42	O-RING	1	SEE DIST.

* ITEM INCLUDED IN CYLINDER SEAL KIT
** ITEM INCLUDED IN MOTOR SEAL KIT

TABLE 2 - PISTONS/CYLINDERS
SUB ASSEMBLY Item #7, 8, 10, 11

DIA	DISP.	DESCRIPTION	PART #
Ø28	100	Sub Assembly	0148102086
		*Cylinder Seal	0010038001
		*O-Ring	0010012194
		*CYLINDER SEAL KIT #0400-V128	
Ø35	150	Sub Assembly	0148001086
		*Cylinder Seal	0010038002
		*O-Ring	0010012214
		*CYLINDER SEAL KIT #0400-V135	
Ø37	175	Sub Assembly	0148004086
		*Cylinder Seal	0010038019
		*O-Ring	0010012137
		*CYLINDER SEAL KIT #0400-V137	
Ø40	200	Sub Assembly	0148003186
		*Cylinder Seal	0010038004
		*O-Ring	0010012035
		*CYLINDER SEAL KIT #0400-V140	
Ø44	250	Sub Assembly	0148001186
		*Cylinder Seal	0010038005
		*O-Ring	0010012205
		*CYLINDER SEAL KIT #0400-V144	
Ø48	300	Sub Assembly	0148002186
		*Cylinder Seal	0010038007
		*O-Ring	0010012217
		*CYLINDER SEAL KIT #0400-V148	
Ø50	320	Sub Assembly	0148000186
		*Cylinder Seal	0010038008
		*O-Ring	0010012218
		*CYLINDER SEAL KIT #0400-V150	
*CYLINDER SEAL KIT - Item #10, 11			

TABLE 3 - SHAFTS Item #17

DESCRIPTION	STROKE	SHAFT	ASSEMBLY
MALE DIN [7]	32	0106103204	0106103294
MALE UNI [1]	32	0106102204	0106102294
TAPERED [2]	32	0106180204	0106180294
FEMALE DIN [9]	32	0106133204	0106133294
FEMALE UNI [3]	32	0106132204	0106132294
PARALLEL [8]	32	0106120204	0106120294
SPLINED [37]	32	0106167204	0106167294
KEYED [38]	32	0106162204	0106162294
KEYED 1-1/2"[48]	32	0106163204	0106163294
KEYED 1-1/4"[58]	32	0106160204	0106160294
KEYED 1-1/2"[68]	32	0106161294	0106161294

TABLE 4 - SHAFT BEARINGS Item #19

BALL BEARINGS	0010007033
ROLLER BEARINGS	0010007160

MOTOR SEAL KIT # 0051-ORK1

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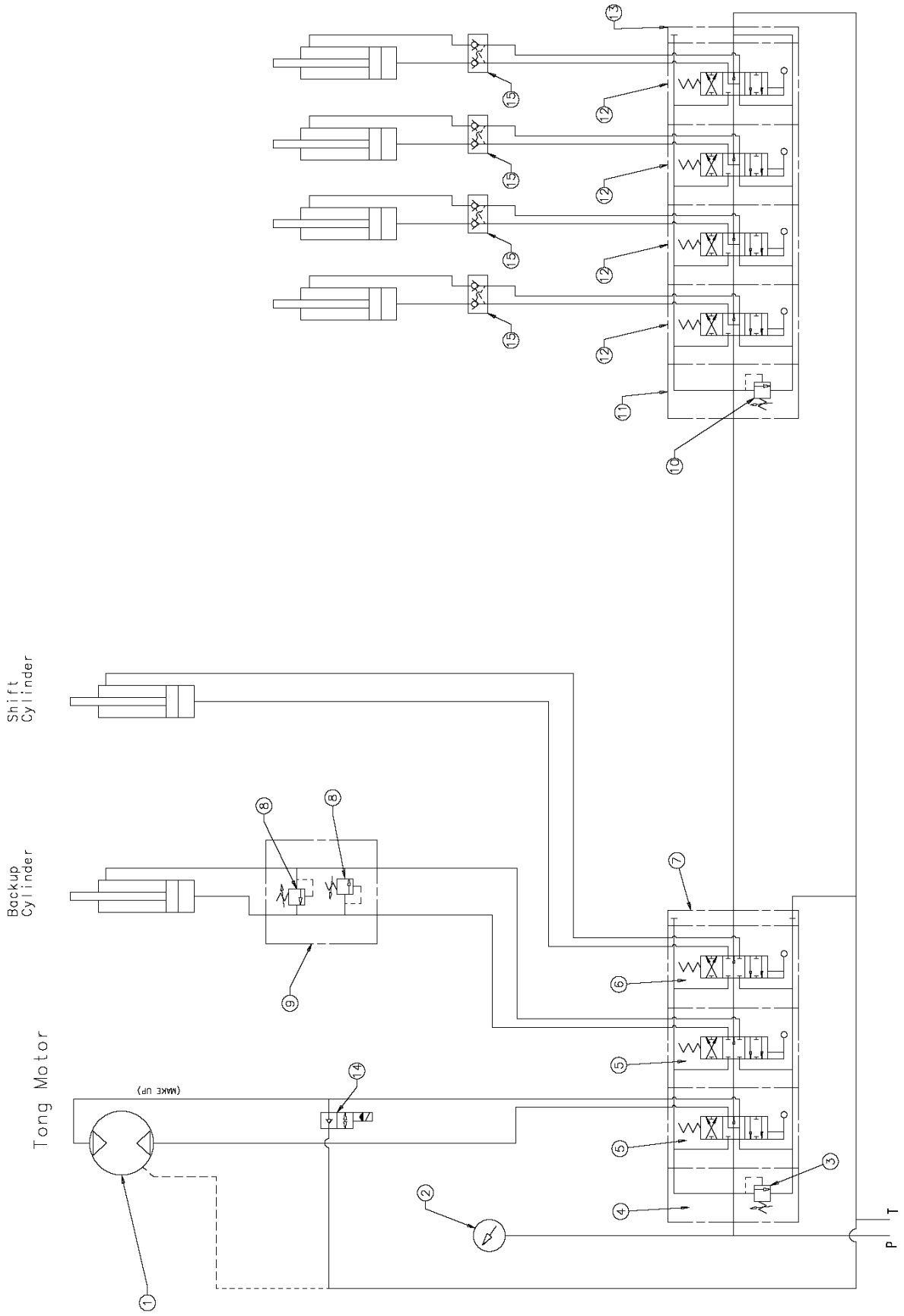
HYDRAULIC SECTION



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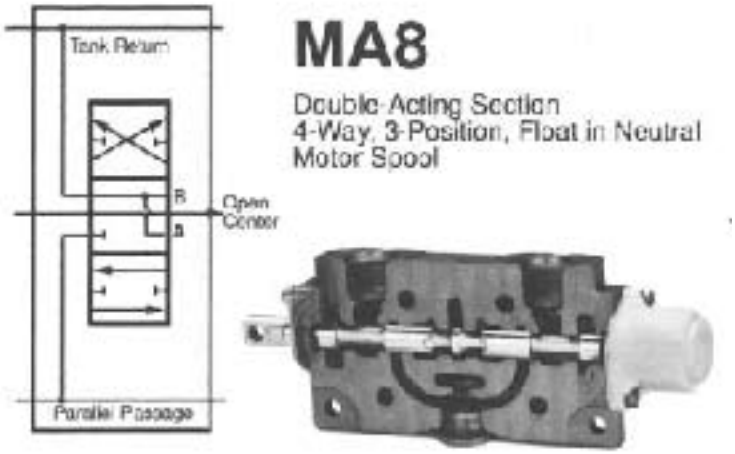
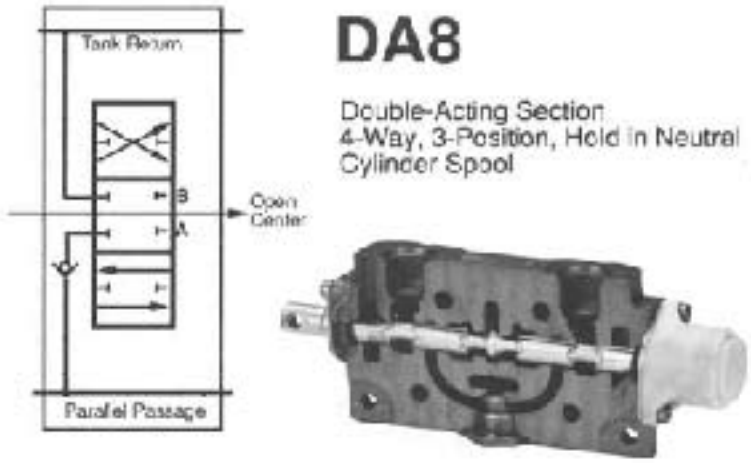
Item	Description	Part Number	Page
1	Hydraulic Motor, SAI GM1-250	87-0148	3.7
2	Pressure Gauge 0 - 3000 psig	02-0245	3.8
3	Relief Valve Cartridge, DVA35-MRV-2	10-0062	3.8
4	Inlet Section, DVA35-A880	10-9016	3.8
5	Motor Valve Section, DVA35-MA8	10-9014	3.8
6	Backup Valve Section, DVA35-DA8	10-9019	3.8
7	Outlet Section, DVA35-PB09	08-1825	3.8
8	Relief Valve Cartridge, RPEC-LAN	08-0095	3.9
9	Cross Port Relief Valve Block, Sun YFI	08-1801	3.9
10	Relief Valve Cartridge, DVA20-MRV	10-0025R	3.9
11	Inlet Section, DVA20-A880	10-0025	3.9
12	Double-Action Valve Section, DVA20-DA7	10-0072	3.9
13	Outlet Section, DVA20-TR88	10-0027	3.9
14	Dump Valve, Vickers SV1-16	60-0322	
15	Cross-Port Check Valve, CKEB-XCN, c/w body, Sun YEI	08-0481 / 08-1898	

DVA35-A880 Inlet Valve



DVA35-MA8 Parallel Circuit, Low-Boy Work Section



DVA35-DA8 Parallel Circuit, Low-Boy Work Section

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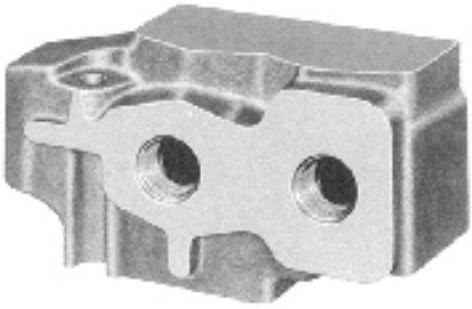
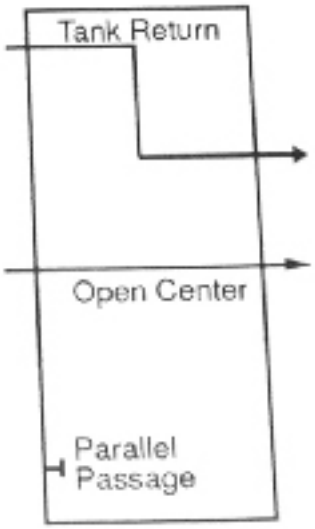
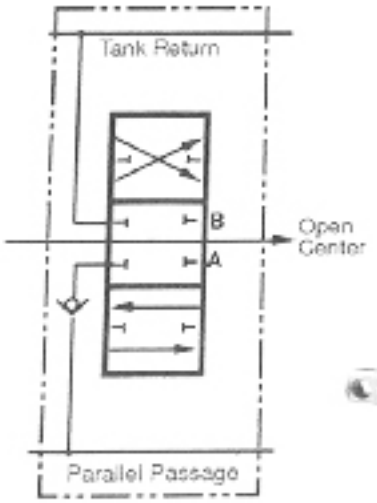
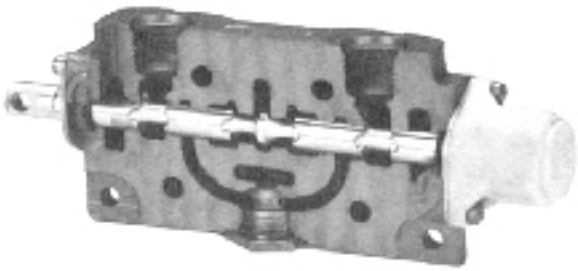


DVA35-PB09 Pressure Beyond Valve

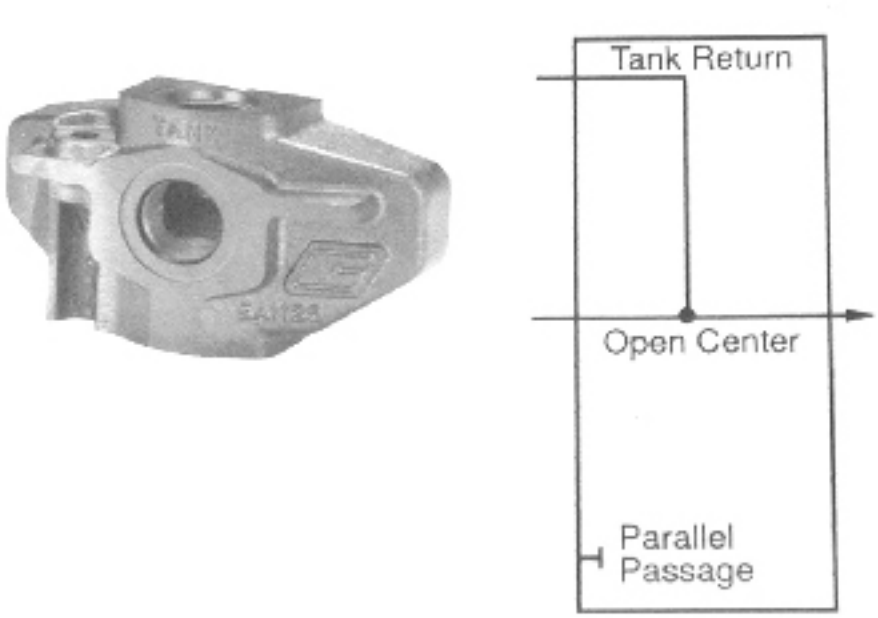




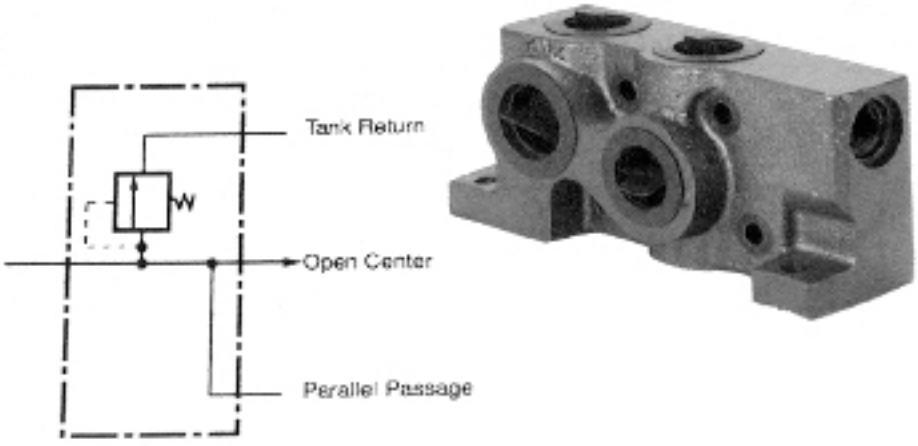
DA7
Double-Acting Section
4-Way, 3-Position, Hold in Neutral
Cylinder Spool



DVA20-DA7 Parallel Circuit, Low-Boy Work Section



DVA20-TR88 Outlet Valve, Tank Return Type



DVA20-A880 Inlet Valve

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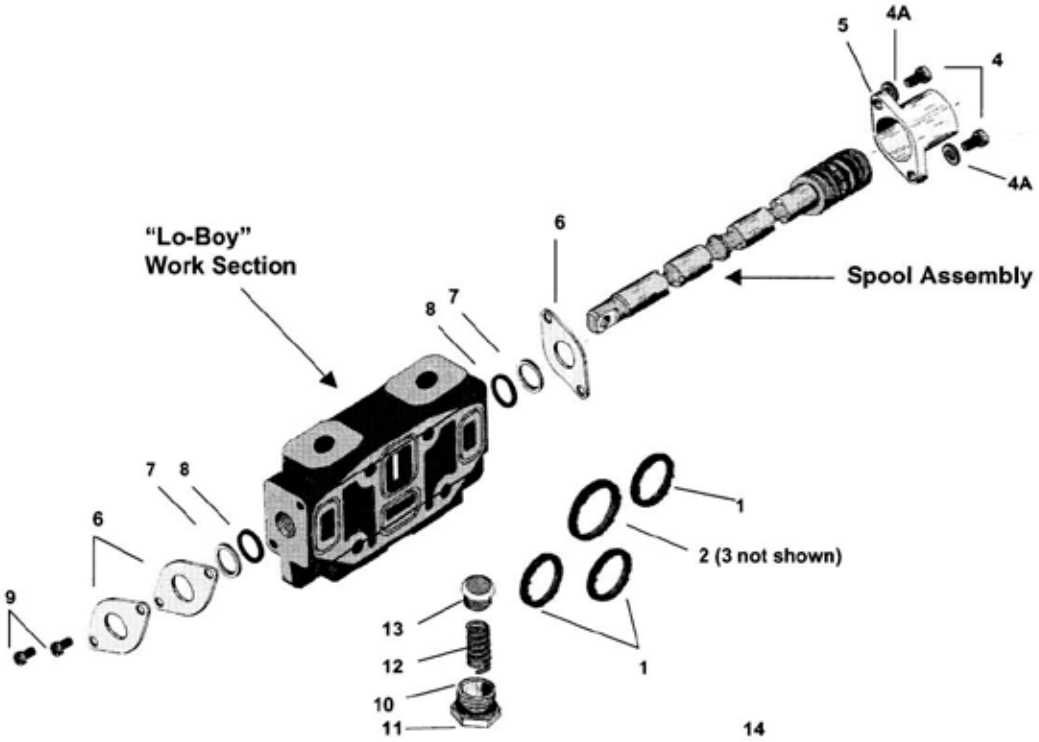

Figure 3

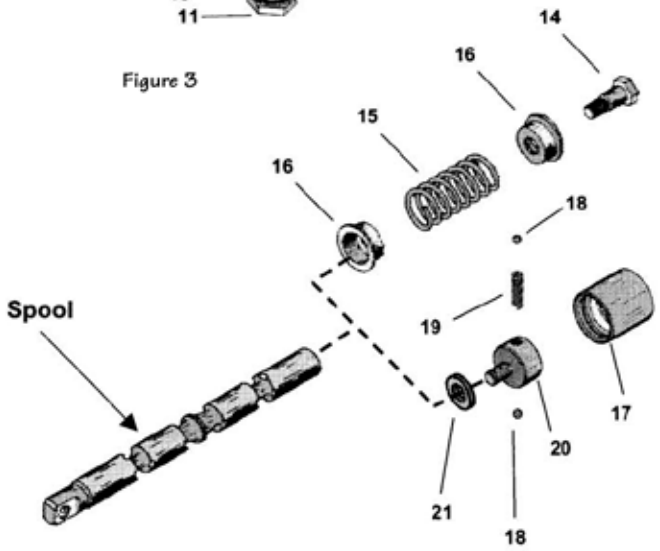

Figure 4

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VA20 / VA35 Valve Sections				
Parallel Section Seals				
Item	**Type**	**Description**	**Qty**	**Part Number**
1	Part	Square Seal For Parallel Lo-Boy Valve Section	1	02-0080
2	Part	Square Seal For Parallel Lo-Boy Valve Section	3	02-0081
PARALLEL SECTION COMPONENT PARTS - See figures 3 & 4				
4	Part	Back Cap Screw	2	02-0084S
5	Part	Back Cap	1	02-0084
6	Part	Retainer Plate	3	02-0086
7	Part	Back-Up Ring	2	02-0087
8	Part	Spool Seal	2	02-0088
9	Part	Retainer Plate Screw	2	02-0086S
10	Part	Check Valve Cap	1	
11	Part	Check Valve O-Ring Seal	1	
12	Part	Check Spring	1	
13	Part	Check Valve Poppet	1	
Parts 14 through 20 no longer available individually, must be ordered as a Spring Return kit				
	Kit	Spring Return Kit		02-0090K
14	Part	Stripper Bolt	1	
15	Part	Centering Spring	1	
16	Part	Spring Guide	2	
17	Part	Detente Sleeve	1	
18	Part	Detente Ball	2	
19	Part	Detente Spring	1	
20	Part	Detente Poppet Retainer	1	

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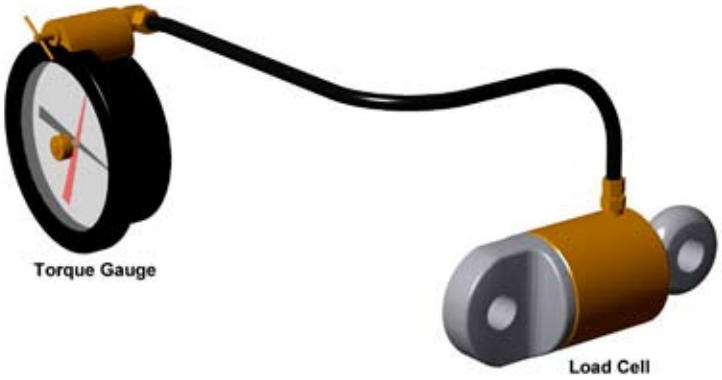
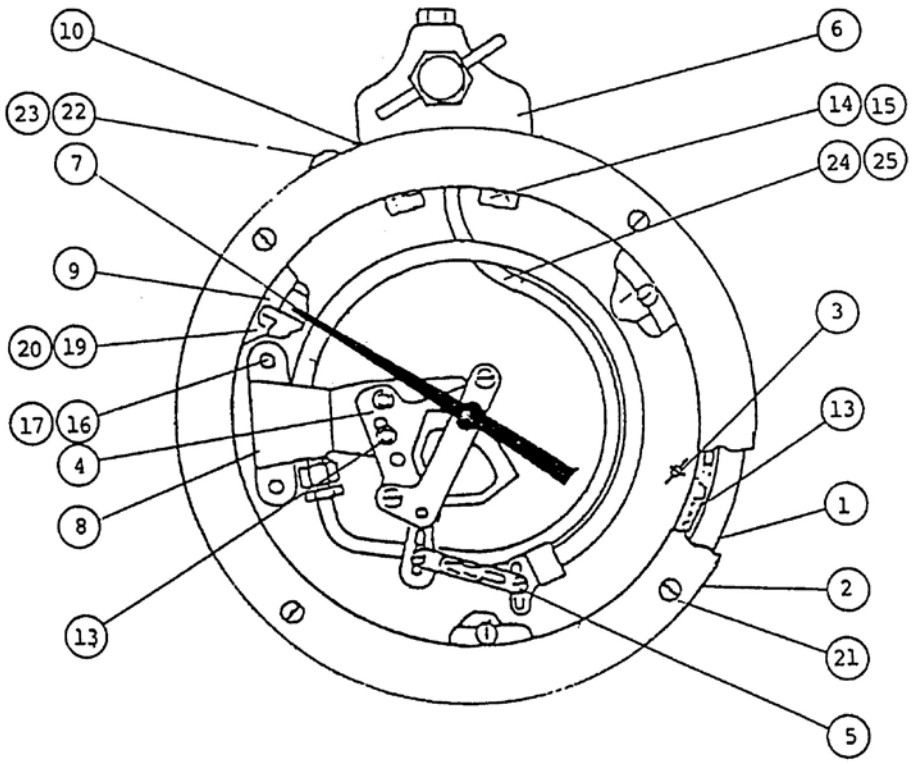


TENSION TORQUE GAUGE - LOAD CELL ASSEMBLY
39" Tourque Arm, 60000 Ft.-Lbs. Face

ITEM	PART N0.	QTY.	DESCRIPTION
1.	10-0008	1	Tension Cylinder- Assembly 4.00 (Load cell Assmembly)
2.	02-0078	2	Shackle Assembly, 16 ton
3.		1	Gauge Assembly, 50,000 ft.-lbs.
4.	01-0087	1	Torque Gauge Flange
5.	02-0069	1	Hose Assembly
6.	09-0037	3	1/4" Lock Washer, Cadium Plated
7 .	09-0032	3	1/4"-20 x 1/2" Lg. Hex Head Machine Screw, Cadium Plated



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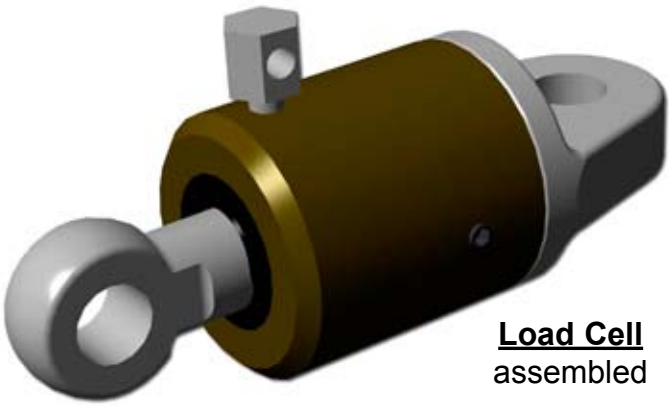
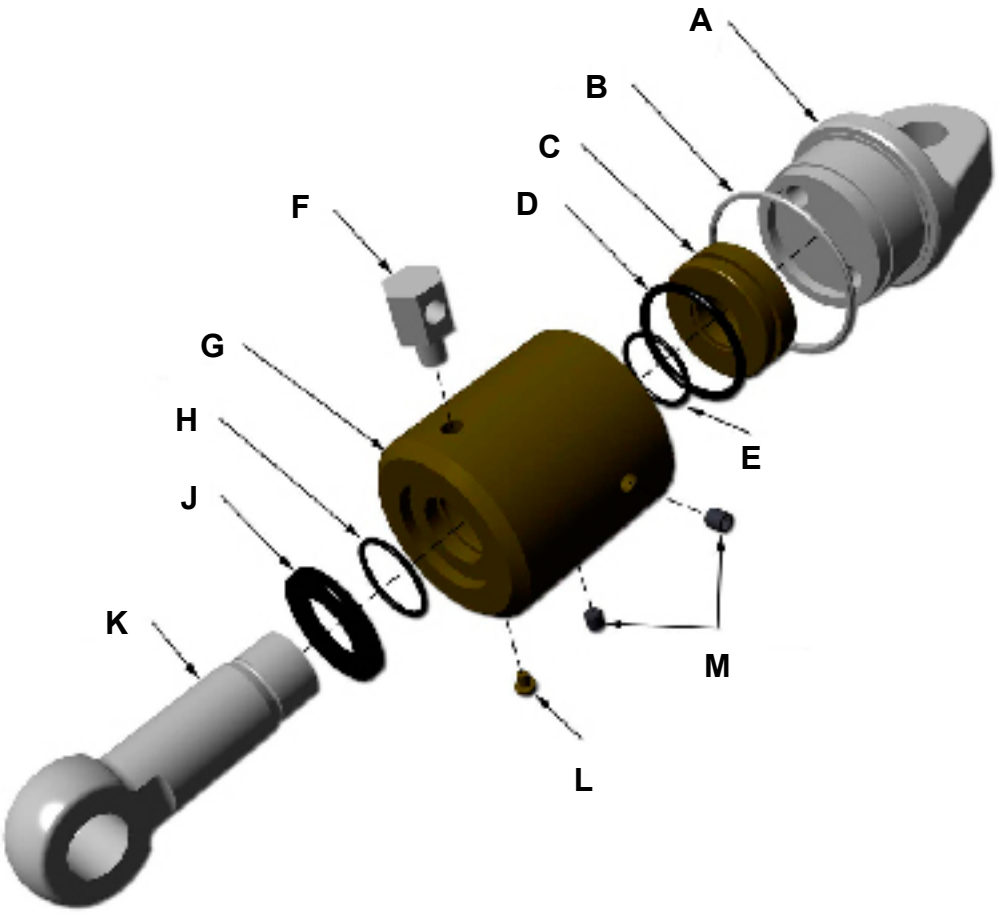
Item	Type	Description	Qty	Part Number
1	Part	6" Gauge Case	1	02-0053
2	Part	Case Ring	1	02-0054
3	Part	Flex Cover wtih Red Pointer	1	02-0055
4	Part	Movement	1	02-0056
5	Part	Linkage	1	02-0057
6	Part	Damper Assembly	1	02-0058
7	Part	Pointer, 6" Black	1	02-0059
8	Part	Bourdon Tube	1	02-0060
9	Part	Dial Face, 12,000	1	10-0042
9a	Part	Dial Face, 20,000	1	10-0044
10	Part	Gasket	1	02-0062
13	Part	Case O-Ring	1	02-0063
14	Part	1/4-20 x 1-1/4" Screw	2	09-0036
15	Part	1/4" Nom. Lock Washer	2	09-0037
16	Part	Tube Mount Screws	3	09-0038
17	Part	O-Ring	3	02-0064
18	Part	Movemount Mount Screws	2	09-0039
19	Part	Dial Screws	5	09-0040A
20	Part	3/4" Lockwashers	5	09-0041
21	Part	Case Ring Pins	4	09-0042
22	Part	3/4" NC x 7-1/2" Hex Cap Screws	1	09-0043
23	Part	3/16" Tubing Kit	1	02-0066
24	Part	Tee	1	08-0022
25	Part	1/4 - 18 NPT Elbow	1	08-0023
26	Part	Nipple	2	08-0027
27	Part	3/8" Female Coupling	1	08-0025
28	Part	Gauge Face Oil	1 Qt	02-0067
29	Part	Plug	1	08-0021
30	Part	O-Ring	1	02-0068



Load Cell
assembled



Load Cell
exploded

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Item	Type	Description	Qty	Part Number
	Assembly	Tension Load Cell	1	TC107
A	Part	Cylinder Head	1	02-0070
B	Part	Flange Gasket	1	02-0073
C	Part	Piston	1	02-0072P
D	Part	O-Ring	1	02-0076
E	Part	O-Ring	1	02-0075
F	Part	1/4" - 18 NPT Elbow	1	08-0023
G	Part	Cylinder Body	1	02-0070
H	Part	O-Ring	1	02-0077
J	Part	Dust Seal	1	02-0074
K	Part	Cylinder Rod	1	02-0072R
L	Part	Screw	1	09-0045
M	Part	Set Screw	2	09-0046

TROUBLESHOOTING

Under normal operating conditions, and with proper maintenance, the torque gauge and load cell system are designed to give lasting trouble-free performance. Faulty indication on the gauge will very often define a fault within the gauge.

*

IF TROUBLESHOOTING REVEALS THAT THERE IS INSUFFICIENT FLUID IN THE SYSTEM, BEFORE RECHARGING, CHECK THAT ALL SYSTEM COMPONENTS ARE FREE FROM DAMAGE. THIS WILL ENSURE THAT FLUID LOSS WILL NOT CONTINUE AFTER RELOADING.

1. *PROBLEM:* *No indication on gauge.*
   POSSIBLE SOLUTIONS: *Obstruction in hose.*
   Loss of hydraulic fluid.
   Gauge internal mechanism damaged.

2. *PROBLEM:* *Gauge indication too high.*
   POSSIBLE SOLUTIONS: *Excessive hydraulic fluid.*
   Internal mechanism of gauge is damaged.

3. *PROBLEM:* *Gauge indication too low.*
   POSSIBLE SOLUTIONS: *Insufficient hydraulic fluid.*
   Snub line not at right-angle to tong handle.
   Gauge internal mechanism damaged.

4. *PROBLEM:* *Erratic or sluggish gauge indication.*
   POSSIBLE SOLUTIONS: *Pointer rubbing glass or dial.*
   Insufficient hydraulic fluid.
   Dirty gauge movement.
   Improper pointer damper adjustment.
   Gauge internal mechanism damaged.

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PERIODIC INSPECTION AND MAINTENANCE

1. *MAINTENANCE*
   - A. *Tong Torque Systems are built to give years of trouble-free service with minimum maintenance. Periodic inspections of the load cell, and hydraulic lines and fittings, are recommended in order to keep the system in top operating condition. A thorough inspection should be made at each rig-up.*
   - B. *Recharge hydraulic system with W15/16 fluid via the filling connection at the top of the indicating gauge. Recharging must only be performed when there is no load on the load cell.*

     Procedure:

     1. *Connect hand pump to filling connection on gauge.*
     2. *Fill hand pump bowl with W15/16 hydraulic fluid and pump fluid into the system until the piston rod on the load cell extends no more than 1/2" from the body.*
     3. *Loosen vent screw on load cell body to permit trapped air to escape during loading.*

* **MAINTAIN GREATER-THAN HALF FULL FLUID LEVEL IN THE HAND PUMP BOWL TO AVOID PUMPING AIR INTO THE SYSTEM. DO NOT ALLOW THE LEVEL TO FALL BELOW ONE-HALF FULL**

     4. *Retighten load cell vent screw when the system has been adequately recharged*

   - C. *Load cell and indicator gauge should be returned to authorized repair facility for any repairs or calibration required.*